ABSTRACT

The seabird colonies at Gull Island and Sixty-Foot Rock, in Kachemak Bay, are the most accessible to the headquarters of the Alaska Maritime National Wildlife Refuge. Gull Island was briefly surveyed in 1984 and 1985. In 1986 we established a full monitoring project. Nine species of seabirds breed on the island. Black-legged kittiwakes are the most numerous species with the population estimated in 1985 at about 8000 breeding birds. This is more than twice the number reported in 1976. Gull Island kittiwakes have one of the highest reproductive rates among colonies in Alaska. Most of the common murres nest at the top of Murre Rock making monitoring of this species difficult. There are about 2300 murres at this colony. Glaucous-winged gulls use the main island. Like kittiwakes, their population more than doubled since 1976. Sixty-Foot Rock was surveyed in 1985 and and monitored more extensively in 1986. Five species of seabirds breed on this rock. It has a population of 460 breeding black-legged kittiwakes making this species the most abundant on the rock. This represents a population increase of nearly 400 birds. Other seabirds breeding here include the glaucous-winged gulls, common murres, tufted puffins and pigeon guillemots.

INTRODUCTION

Gull Island and Sixty-Foot Rock became part of the refuge system when the Alaska National Interest Lands Conservation Act created the Alaska Maritime National Wildlife Refuge. However, in 1986, Gull Island was given an interim conveyance status to the Seldovia Natives and the refuge does not have jurisdiction over the island.

Erikson (1976) conducted the only known prior survey of seabirds at both colonies. This was part of a study to determine the potential impacts of the sale of outer continental shelf lease tracts in lower Cook Inlet.

Gull Island and Sixty-Foot Rock are located within 6 km of the Homer Boat Harbor, making them the most accessible seabird colonies to the headquarters of the Alaska Maritime National Wildlife Refuge (Figure 1). Their location provides a convenient and inexpensive opportunity for the refuge to study seabirds.

In this project, we monitor reproductive success of black-legged kittiwakes (Rissa tridactyla) and two species of cormorants. We also estimate populations of kittiwakes, pelagic cormorants (Phalacrocorax pelagicus), red-faced cormorants (P. urile), tufted puffins (Fratercula cirrhata), common murres (Uria lomvia) and glaucous-winged gulls (Larus glaucescens).

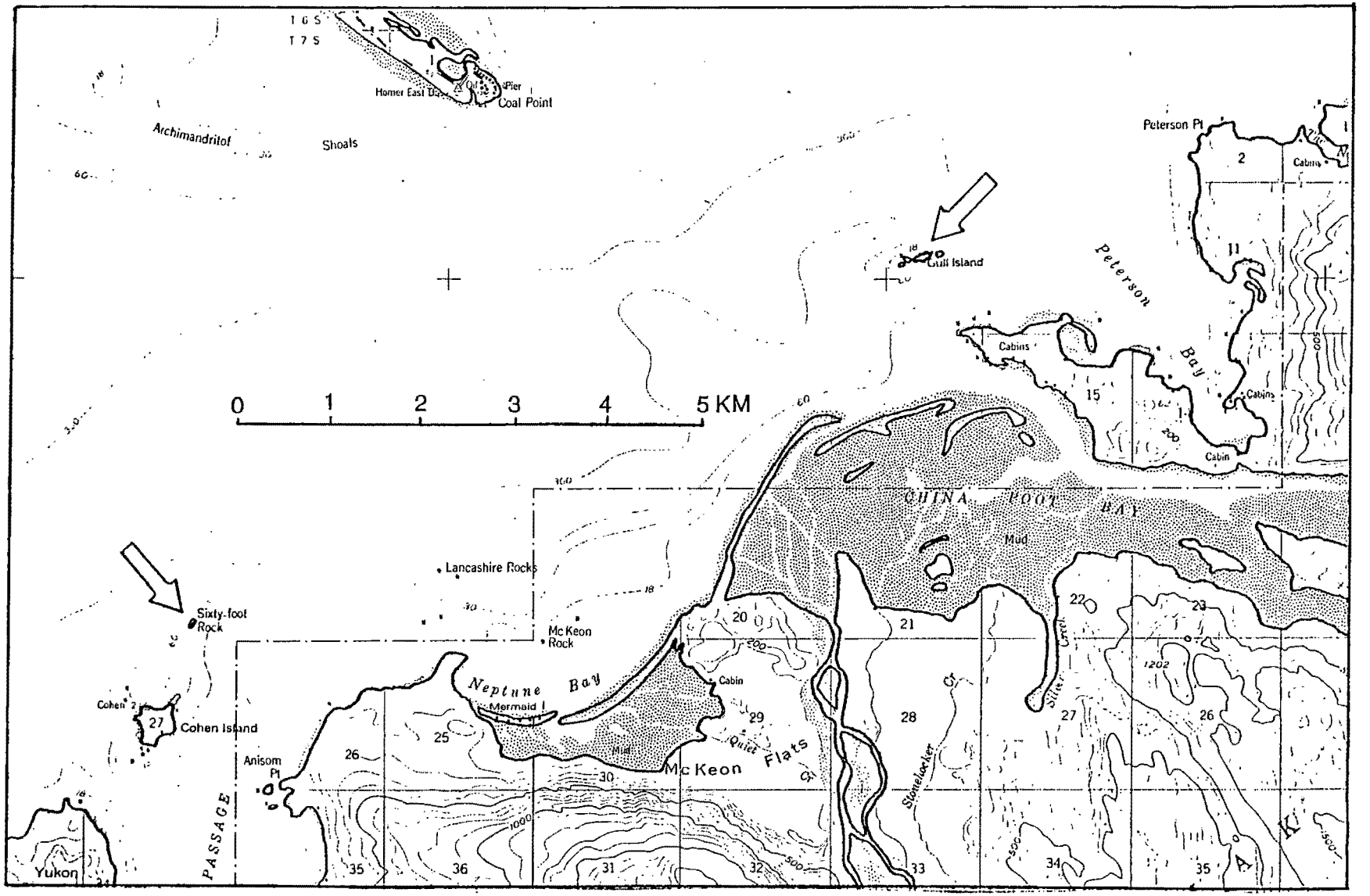

Figure 1. Vicinity map of Gull Island and Sixty-Foot Rock in Kachemak Bay, Alaska.

STUDY AREA

Kachemak Bay is situated at the southeast entrance of Cook Inlet and is 62 km long and 38 km wide at its mouth. Homer is located near the north-central part of the bay where the Homer Spit extends 7 km southeasterly into the bay. The north side of the bay generally consists of mud flats and is surrounded by bluffs. The other side of the bay is much deeper with numerous coves and islands including Gull Island and Sixty-Foot Rock. Gull Island consists of one vegetated island and three rocky islets (Figure 2). The main island and two of the islets, Gorilla and Murre rocks, provide nesting habitat for seabirds. The other islet is used by roosting gulls and cormorants. The highest point on the main island is 28 m.

Cow parsnip (Heracleum lanatum) and stinging nettle (Urtica sp.) dominated the vegetation on the main island. Other less common plants include: hemlock parsley (Conioselinum chinense), seawatch angelica (Angelica lucida) and blue joint grass (Calamagrostis canadensis). Vegetation covered much of the island except for a 1 m fringe around its periphery.

Sixty-foot Rock is located in outer Kachemak Bay next to Cohen Island. The rock is about 80 m long and 10 m wide. It is unvegetated with vertical cliffs on all sides. Most of the black-legged kittiwakes nest on its east side and common murres use the top.

METHODS

We made reconnaissance surveys in 1984-85 to evaluate the feasibility of monitoring Gull Island and Sixty-Foot Rock. But it was not until 1986 that we had a monitoring plan for both colonies.

1984

During 1984, we made a count of individual birds on May 18, while circumnavigating Gull Island from a 25-foot Boston Whaler. We had one person operate the boat, another count and the third person record. Like all 1984 population estimates, we only made single counts. On June 29, we made kittiwake nest counts at Gull Island and Sixty-Foot Rock. We counted nests at Gull island again on July 13. We took another trip to Sixty-Foot Rock on July 24 and counted pelagic cormorants, glaucous-winged gulls, common murres and tufted puffins.

We established three productivity plots at Gull Island on July 27, and made replicate counts of chicks, adults and nests (Figure 2). Polaroid photographs were taken for future reference. On July 31, we landed on Gull Island (main island) and counted puffin burrows. Common murres on Murre

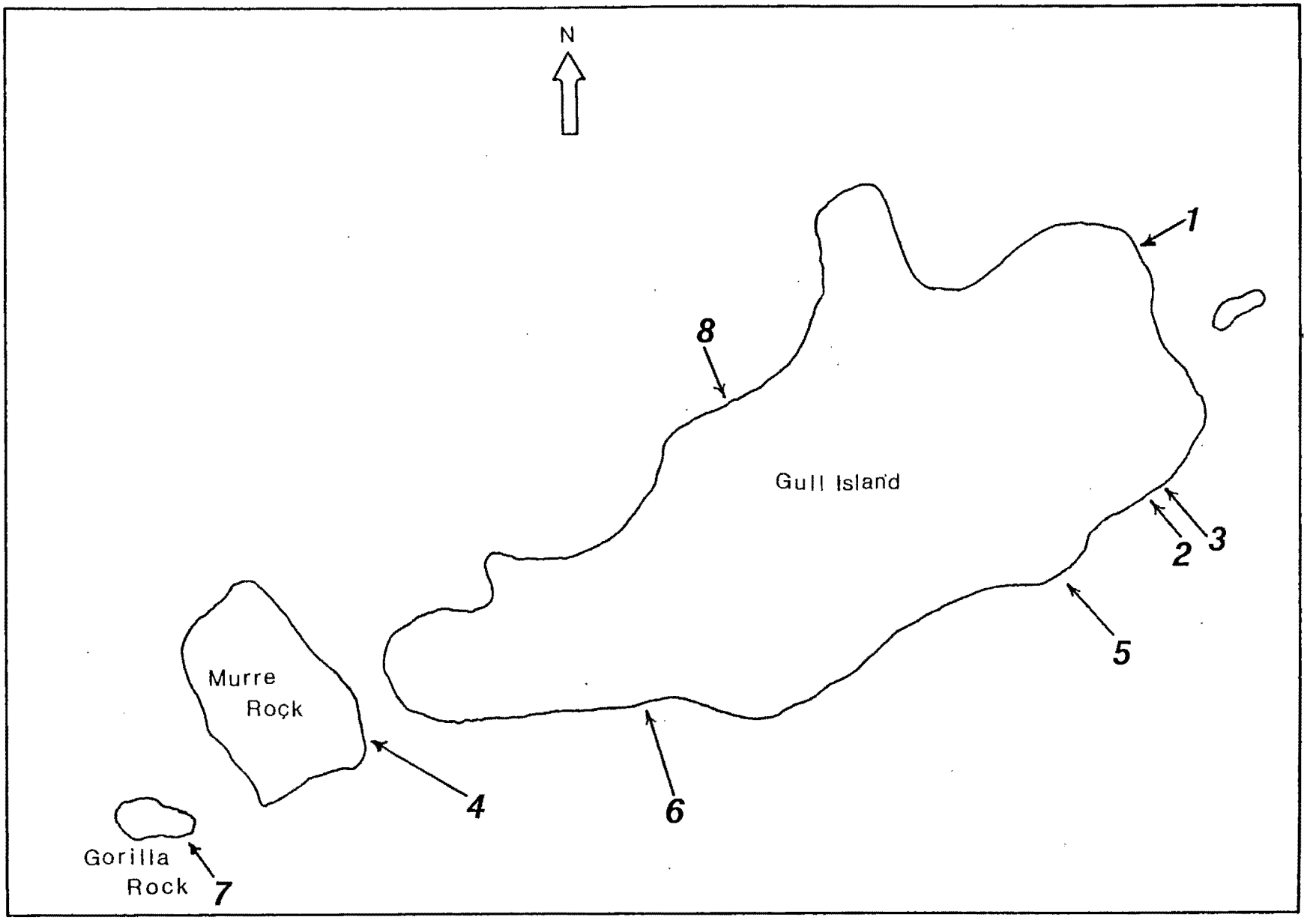

Figure 2. Gull Island complex with locations of kittiwake study plots

Rock were counted from the navigational light on Gull Island at about 0700 hours. At least five replicate counts would be needed to get accurate estimates of murres. Since this is a small island with cliff nesters using most of the island, we felt that this species could not be monitored without disturbing other seabirds. Thus, all murre estimates represent single counts. We made our last black-legged kittiwake nest count at Sixty-foot Rock on August 1, 1984.

1985

In 1985, we first visited both colonies on May 20 and counted individuals. Another count of birds at Gull Island was started on June 6 and then completed on June 12. During this survey, we counted all cliff sections twice or until separate counts fell within 5% of each other. We counted adult birds on Gull Island again on July 11. This was based on single counts.

On August 14, two plots were monitored for reproductive success. We censused the three plots established at Gull Island in 1984, on August 20, and added three more. Two more plots were established and censused on August 23 (Figure 2). On the same day, we also established two black-legged kittiwake plots on Sixty-Foot Rock and censused them, as well as the entire colony (Figure 3). All plots were counted at least twice as described above. The counts were about two weeks later than the optimal counting period for kittiwakes. About 90% of the chicks had well developed primaries and young-of-the-year were flying or on the water.

1986

We monitored seabirds at Gull Island in 1986 according to the following schedule:

June 10 Black-legged kittiwake nests and adults were counted on all plots except plot 3. Each plot was counted at least twice or until separate counts fell within 5% of each other. All common murres within the plots were also counted.

June 11 We checked glaucous-winged gull nesting attempts on the main island. The entire island was searched by two people for nests; nest contents were recorded. Nests were defined as depressions where new vegetative material had been added during the breeding season.

July 14 Nests and/or adults of black-legged kittiwakes, cormorants and common murres were counted on eight study plots. About a third of the nesting cliffs were also counted.

July 29 Nests or adults and chicks of black-legged kittiwakes, cormorants and common murres on cliff sections were counted, but study plots were not surveyed.

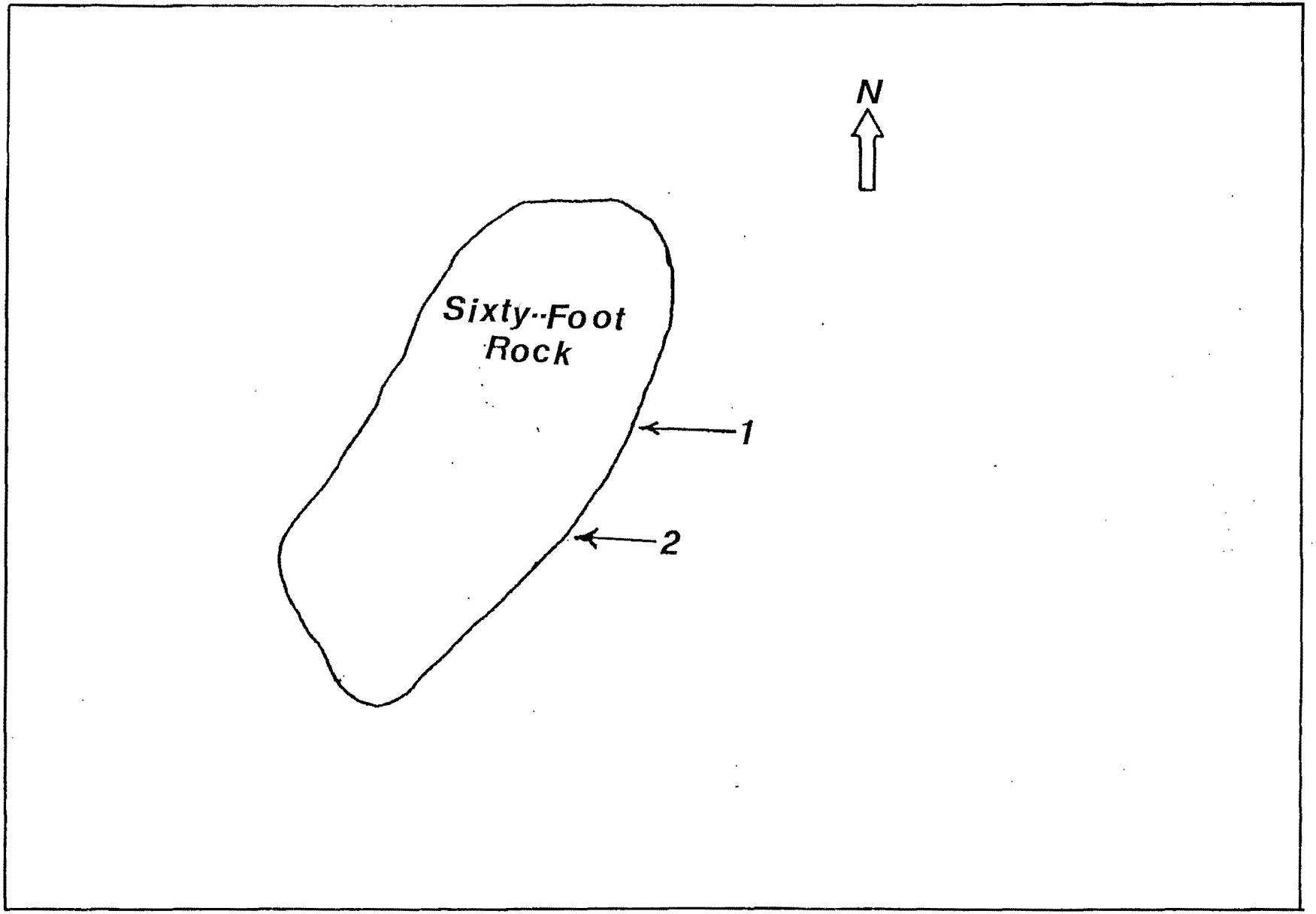

Figure 3. Sixty-Foot Rock with locations of study plots.

July 30 Nests or adults and chicks of black-legged kittiwakes, cormorants and common murres were counted on all plots except plots 6 and 7. Chicks on the latter two plots could not be accurately counted due rough seas.

July 31 Adult black-legged kittiwakes and murres were counted on all plots. In addition, adults, nests, and chicks of cormorants on the plots as well as nests and adults over the entire island were counted.

August 1,2 Adult black-legged kittiwakes and common murres were counted on plots.

August 3 Cormorant adults, nests and chicks were counted on plots as well as black-legged kittiwake nests and adult common murres.

We monitored seabirds at Sixty-Foot Rock on the following dates in 1986:

July 29,30 Black-legged kittiwake adults, nests and chicks as well as adult common murres were counted on plots and over the entire island.

July 31, August 1,2 Adult black-legged kittiwakes and common murres were counted on plots and the entire island.

Population estimates presented in Table 1 were based on the high count where separate counts showed high variability. When numbers were similar on separate days of counting we took the mean of those estimates. Our earliest nest count was used to determine nesting attempt. Chick counts were generally based on a single count day. If we had several sets of data we took the mean of the most clustered estimates. Observers sometimes mis-identified red-faced cormorants, but the corrected results are presented in Tables 1 and 2.

RESULTS AND DISCUSSION

GULL ISLAND

Cormorants

The pelagic cormorant population fluctuated between 1976 and our survey period (Table 1). However, the 1976 and 1986 figures were relatively stable with estimates of about 200 breeding birds. Red-faced cormorants occurred in lower

Table 1. Comparison of common seabirds at Gull Island and Sixty-Foot Rock, Alaska.

Colony	PECO	RFCO	BLKI	GWGU	COMU	PIGU	TUPU
Gull Island							
1976	222	62	3194	216	3200	12	530
1984	(54)	(4)	(4204)	200	2652	5	(71)
1985	105	14	8202	442	1994	13	8
1986	272(111)	45(14)	--	(286)	--	--	--
Sixty-Foot Rock							
1976	0	0	68	64	350	0	52
1984	30	--	(199)	21	234	--	17
1985	28	0	(177)	--	91	--	--
1986	13	0	289(230)	113	99	2(1)	13

PECO=Pelagic cormorant, RFCO=Red-faced cormorant, BLKI=Black-legged kittiwake, GWGU=Glaucous-winged gull, COMU=Common murre, PIGU=Pigeon guillemot, TUPU=Tufted puffin
( )=Nests or burrows

Table 2. Reproductive success of cormorants and kittiwakes at Gull Island and Sixty-Foot Rock, Alaska.

Area	Pelagic Cormorants		Black-legged Kittiwakes	
	Nests	Chick/Nest	Nests	Chick/Nest
G1				
1984	--	--	30	1.13
1985	--	--	33	0.39*
1986	1	2	44	0.80
G2				
1984	--	--	24	0.63
1985	--	--	26	0.38
1986	0	0	48	0.42
G3				
1984	--	--	26	0.58
1985	--	--	31	0.65
1986	0	0	66	0.89
G4				
1984	--	--	--	--
1985	--	--	34	0.26
1986	0	0	40	0.78
G5				
1984	--	--	--	--
1985	--	--	102	0.19
1986	1	0	161	0.67
G6				
1984	--	--	--	--
1985	--	--	148	0.28
1986	11	0.52	208	--
G7				
1984	--	--	--	--
1985	--	--	76	--
1986	2	0	126	--
G8				
1984	--	--	--	--
1985	--	--	54	0.54
1986	5	0.80	76	0.62
Gull Island Plots (pooled data)				
1984	--	--	80	0.80
1985	--	--	428	0.33
1986	20	0.65	769	0.69

G=Gull Island plots, S=Sixty-Foot Rock plots
*=Plots G1 and G4 had 0.86 and 1.28 chicks/nest a week earlier

Table 2. Continued.

Area	Pelagic Cormorants		Black-legged Kittiwakes	
	Nests	Chick/Nest	Nests	Chick/Nest
S1				
1984	--	--	--	--
1985	--	--	14	0.21
1986	0	0	52	0.62
S2				
1984	--	--	--	--
1985	--	--	21	0.10
1986	0	0	23	0.61
Sixty-Foot Rock (entire island)				
1984	--	--	199	--
1985	--	--	177	0.10
1986	0	0	230	0.40

Table 3. Counts of adult cormorants, black-legged kittiwakes and common murres at Gull Island and Sixty-Foot Rock.

Area	Pelagic Cormorants	Black-legged Kittiwakes	Common Murres
G1			
1984	--	57.0	--
1985	--	61.0	22.0
1986	1	69.3	18.2
G2			
1984	--	31.0	--
1985	--	29.0	27.0
1986	0	49.3	29.2
G3			
1984	--	57.0	--
1985	--	59.0	0
1986	0	88.3	19.4
G4			
1984	--	--	--
1985	--	42.0	0
1986	0	55.5	0
G5			
1984	--	--	--
1985	--	155.0	0
1986	2	213.0	7.0
G6			
1984	--	--	--
1985	--	224.0	0
1986	38	265.8	25.0
G7			
1984	--	--	--
1985	--	--	--
1986	2	151.5	4.6
G8			
1984	--	--	--
1985	--	--	--
1986	11.5	100.0	3.3
Gull Island Plots (pooled data)			
1984	--	145.0	--
1985	--	570.0	49
1986	54.5	992.7	106.7

G=Gull Island plots S=Sixty-Foot Rock plots

Table 3. Continued.

Area	Pelagic Cormorants	Black-legged Kittiwakes	Common Murres
S1			
1984	--	--	--
1985	--	--	0
1986	0	61.4	0.6
S2			
1984	--	--	--
1985	--	--	23.0
1986	0	34.4	31.6

numbers than pelagics and had decreased since 1976. One or two double-crested cormorants (Phalacrocorax auritus) occasionally roost on the island, but we have never observed breeding birds here.

Pelagics were the only species of cormorants present on our kittiwake productivity plots. There were usually few nests or adult birds per plot except at plot 6 (Tables 2, 3). Since cormorants may use different nest sites from year to year, a complete island count would provide a better estimate of the population. We kept productivity data from plots, but they may underestimate fledging success because an unobstructed view of all chicks are sometimes difficult when observations are made by boat. This would be particularly true of broods greater than two. In the future, we could either make several chick counts on questionable nests or measure productivity as the percent of nests with chicks. Counts scheduled in late July, during a normal year, should continue.

Glaucous-winged Gulls

The population of glaucous-winged gulls more than doubled since 1976. We found 286 nests with a mean of 1.5 eggs/nest and 2.29 eggs/nest with eggs on June 11, 1986 (Appendix C). This compares with 216 gulls estimated in 1976 (Erikson 1976). We also counted 200 birds in May 1984, during a cursory survey of the colony. Although the island is small, it would be difficult to monitor fledging success because chicks will hide in the tall grass and empty puffin burrows.

Black-legged Kittiwakes

Kittiwakes arrived on Gull Island in mid-March during 1984. In 1985, they arrived in late April and the following year we first recorded their presence in May. Their later arrival times in 1985-86, compared to 1984, could be due to lower air temperatures (Table 4). Lower temperatures could not explain why kittiwakes arrived later in 1986 than in 1985. At other Cook Inlet colonies, kittiwakes were first observed in March 1970/71 at Chisik Island (Snarski 1971) and were already present by May 3, 1978, at East Amatuli Island (Manuwal 1980).

Kittiwakes begin egg laying in early June. In 1986, we found about a third of the nests with eggs at Gull Island on June 11. A similar date was estimated for 1985 by back calculating from the fledging date. This agrees with Snarski (1971) who estimated egg laying on Gull Island to occur around early-mid June in 1971. By comparison, the laying period at Chisik Island occurred from late June to early July the same year (Snarski 1971). Egg laying at East Amatuli occurs in June (Manuwal 1980).

Using an incubation period of 27 days (Coulson and White 1958) we estimated hatching to occur around mid-July. Fledging occurs during the third week of August based on a 43 day rearing period (Coulson and White).

Table 4. Mean air temperatures (F) at Homer, Alaska.

Month	1984	1985	1986
January	26.7	36.0	29.7
February	22.6	20.4	26.9
March	38.0	30.0	26.8
April	36.5	27.9	32.4
May	43.9	41.4	42.1
June	52.3	46.9	48.0
July	54.6	53.5	53.1
August	54.9	51.8	52.4

We need to refine collection of phenological information at Gull Island to calibrate the phenologies of other Gulf of Alaska colonies. This would be useful for scheduling monitoring trips to the Chiswell Islands, Chisik Island and East Amatuli Island.

The kittiwake population more than doubled since 1976 (Table 1). In 1984 we made an estimate of 8408 breeding birds, based on nest counts, this compares with 3194 kittiwakes reported in 1976. The number of nests as well as adults at plots 1-3 further suggest that kittiwake numbers are still increasing (Tables 2,3).

Kittiwakes at Gull Island produced more young per pair than any other Gulf of Alaska colony which was monitored in 1984. The highest productivity rate of other Gulf colonies was 0.67 chicks/nest at Middleton Island in 1984; this was the best reproductive rate for Middleton (Hatch 1986). By comparison we recorded 0.80 chicks/nest during the same year at Gull Island. In 1985, the Middleton colony failed whereas Gull Island continued to do well. Reproductive success was relatively low in 1985 because the colony was monitored after some of the chicks had fledged. However, two plots monitored prior to fledging had productivity rates of 0.86 and 1.28 chicks per nest (see footnote Table 2). Even on the partially fledged plots, we still had an average of 0.33 chicks/nest (Table 2) while all other gulf colonies failed except Prince William Sound where 0.15 chicks/nest was recorded (Hatch 1986).

The highest known productivity rate in the gulf was 1.23 chicks/nest that was recorded at Kulichkof Island near Kodiak in 1977 (Nysewander and Barbour 1979). This was a good year

for gulf kittiwakes. In that year, kittiwake colonies in the gulf produced a mean of 0.65 chicks/nest (Hatch 1986). Unfortunately, there are no comparable 1977 data for Gull Island kittiwakes. In recent years productivity at Kulichkof has declined to 0.42 chicks/nest and no young in 1984 and 1985 respectively.

Common Murres

Most of the murres use the top of Murre Rock with smaller numbers located on ledges on Gorilla Rock and Gull Island. We counted 2652 birds in 1984 when we landed on Gull Island to view birds on Murre Rock (Table 1). Lower numbers were observed the following year, but we did not land on the island. Although our estimates were lower than the 1976 estimate, they could represent differences in attendance patterns rather than real population changes. Because of the potential of disturbance, we should continue to monitor murres by photographing the Murre Rock colony and make single counts. Time lapse cameras could be used, but may be vandalized.

Pigeon Guillemots

We counted 12 and 13 guillemots in 1985 compared to 12 reported in 1976. Like the murre estimates, our count represents a broad estimate of the population. Our counts were made during mid-day in late May and early July. By comparison, the suggested monitoring period for guillemots is between 0500-0800 hours during the pre-laying with 10 replicate counts.

Tufted Puffins

Our count of 71 burrows in 1984 was much lower than the estimate of 530 breeding birds reported in 1976. A tour boat operator observed that puffin numbers declined after the 1983 El Nino event and have not recovered to former levels. We had planned to monitor puffin burrows for fledging success in late August 1986, but lacked sufficient time.

SIXTY-FOOT ROCK

Pelagic Cormorants

We have not found any nesting cormorants on Sixty-Foot Rock. However, pelagics can be seen roosting on the west side of the rock. We counted 28 birds in 1985 and 13 were observed the next year (Table 1). No cormorants occurred on our study plots (Tables 1,3). An occasional red-faced or double-crested cormorant may also roost on the island.

Glaucous-winged Gulls

Gull numbers doubled since 1976. We made a count of 113 gulls in 1986 (Table 1) compared to 64 reported in 1976. Our counts, however, were based on adult birds. A nest count would be needed to get a more accurate estimate of the breeding population.

Black-legged Kittiwakes

Kittiwakes increased by more than five times since 1976 (Table 1). The population has shown an increasing trend in all years except 1985. In that year, kittiwakes may have responded to the cold spring that also affected many other colonies in Alaska. We collected productivity data beginning in 1985, but some of the chicks had fledged at the time of our chick counts. This year we checked the colony before the fledging period and recorded 0.40 chicks/nest for the entire colony. This is a lower rate than our two plots which had 0.62 and 0.61 chicks/nest. The Sixty-Foot Rock colony did not do as well as the Gull Island kittiwakes which produced 0.69 chicks/nest.

Common Murre

Most of the murres use the top of the rock, but some can be found on ledges on the east side. Our counts were lower than those made in 1976 (Table 1). This difference could be due to the variability in the attendance pattern since only single counts were made. In 1986, we made all counts from a boat which further affected the accuracy of our estimates. It would be difficult to get accurate estimates here, but we could detect major population trends by total counts and photographing the colony. Alternatively, we could land on the rock and make egg counts at three to five year intervals. This technique would cause major disturbance to the colony and probably should not be attempted.

Pigeon Guillemot

Only a few guillemots use Sixty-foot Rock. On July 31, 1986, we saw a bird enter a crevice at the cliffs on the west side of the rock.

Tufted Puffins

Puffin numbers were lower than in 1976. We found 13 and Erikson (1976) reported 52. The rock is unvegetated and no burrows could be observed from the water.

RECOMMENDATIONS

The seabird colonies of Kachemak Bay and particularly Gull Island are popular among visitors and residents of Homer. Both colonies are easily reached in the relatively calm waters of the bay. These colonies provide an important focus for educating the public about seabirds as evidenced by numerous inquiries at the refuge during the summer. Information about these colonies are useful to demonstrate how the study of seabirds provide an important indicator to health of the ocean ecosystem.

Data collected on Gull Island further suggests that it is a consistent high producer of kittiwakes and in contrast with other Alaskan kittiwake colonies. Its proximity to refuge headquarters and calm waters of the bay provide an ideal opportunity to study biological and physical oceanographic parameters that may influence fledging success.

Although we have recognized the value of both colonies, they seem to have been given low priority in time and equipment. While the FWS 25-foot Boston Whaler is moored in Homer, it belongs to the Kenai NWR. This sometimes results in greater demand than available boat time. In 1985 this resulted in scheduling colony visits after the kittiwakes had fledged. This problem is further compounded since the refuge staff are involved in several projects and schedules may not coincide with the availability of the boat. These colonies must be recognized as important monitoring sites. A second boat must be made available when there are schedule conflicts with the Boston Whaler.

The inventory plan for this project seems reasonable, but several changes should be considered as described below.

Gull Island

Cormorants

-continue total nest counts.
-count chicks over the entire colony and make several replicate counts on separate days to account for chicks that are difficult to see.

Glaucous-winged Gulls

-continue nest counts.

Black-legged Kittiwakes

-continue monitoring plots as in the past.
-examine the feasibility of using disturbed plots similar to the method used on Middleton Island.
-make complete nest counts at least every three years beginning with the summer of 1987.
-count chicks over the entire island in the same year as the total nest counts to compare plot data with the overall colony.

Common Murres

-continue monitoring as in previous years.

Pigeon Guillemots

-make counts at dawn during the pre-laying period at least every three years

Tufted Puffins

-count burrows every three years.

Sixty-Foot Rock

Cormorants,Black-legged Kittiwakes, Common Murres and Tufted Puffins

-follow the existing monitoring plan

Glaucous-winged Gulls

-land on the rock and make nest counts.

The interim conveyance of Gull Island to the Seldovia Native Association could threaten future monitoring of this colony. The Service may decide not to fund a project on non-refuge lands. We recommend that every effort be made to acquire this important seabird colony. Regardless of ownership, we recommend that the refuge continue to monitor this colony for its public education value and its unique tendency to be a consistently high producer of kittiwakes.

ACKNOWLEDGMENTS

We had help from various people throughout this project. In 1984, we had help from Student Conservation Association volunteer Laura Hoffman and YCC student Kathy Libal. In mid-July, assistant refuge manager Tom Early and volunteer Clark Richins made seabird population estimates at Gull Island. The following year several people assisted us for short periods including the following volunteers: Janie Brixey, Lisa Climo, Don Dragoo, Tony Berto, and Hal Smith. We also had help from YCC student Donna Jones and biological technicians Paul Sievert and Leslie Slater. In 1986 the early spring counts were made with the assistance of Brigit Christiansen, Colleen Baggot Don Dragoo and Gavin Wright. In July ARM Early and volunteer Annette Emig assisted in the counts. Vern Byrd provided valuable suggestions in the design of the project as well as assistance in the field. Thanks also to Dave Nysewander for reviewing a draft of this report.

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Appendix A. Data summary for Gull Island during 1984.

Nesting Attempt Form

Island Gull 1984 Breeding Season

Plot	Date	Time	Vis	Wind	PECO	RFCO	BLKI	GHGU	COMU	PIGU	TUPU
Total Island	840629	0830-1045	1	—	(54)	(4)	(4,204)	—	—	—	—
"	840713	0945- —	"	—	0	(105)	(3,326)	(3)	—	—	—
"	840731	0600-0900	"	—	—	—	—	—	2652	—	(71)
"	840518	1400-1430	"	—	87 unidentified cormorants		4500	200	2500	5	15

Nests in parenthesis

A-1

Reproductive Success Form

Gull Island

1984 Breeding Season

Plot	Date	Time	Vis	Wind	Pelagic Cormorants					Kittiwakes				Common Murre
					Ad	0	1c	2c	3c	Ad	0	1c	2c	
1	840727	1445-1730	1	—	—	—	—	—	—	57	5	16	9	—
2	"	" "	"	—	—	—	—	—	—	31	9	15	0	—
3	"	" "	"	—	—	—	—	—	—	57	11	15	0	—

Appendix B. Data summary for Gull Island during 1985.

Nesting Attempt Form

Island Gull Island 1985 Breeding Season

Plot	Date	Time	Vis	Wind	PECO	RFCO	BLKI	GMGU	COMU	PIGU	TUPU
Gull	860606	0930-1130	1	—	40	50	3838	24	375	—	2
Murre R.	"	" "	"	—	0	10	864	2	387	—	0
Gorilla R.	"	" "	"	—	3	0	784	3	76	—	0
Gull	860612	1000-1100	"	5	12	2	1735	368	348	—	0
Murre	"	" "	"	"	0	0	589	37	757	—	0
Gorilla	"	" "	"	"	0	1	392	0	51	—	0
Total Island	860711	1050-1230	"	—	105	14	4655	442	1370	13	8
"	860520	1038-1145	—	—	80	10	2500	130	2030	12	0

Gull = Main islet of the Gull Island complex.

Counts on 6/6 and 6/12, together, equal total Gull Island colony.

B-1

Reproductive Success Form

Gull Island — 1985 Breeding Season

Plot	Date	Time	Vis	Wind	Pelagic Cormorants					Kittiwakes				Common Murre
					Ad	0	1c	2c	3c	Ad	0	1c	2c	
7	850823	—	1	—	—	—	—	—	—	(76)	—	—	—	—
8	"	—	"	—	(1)	—	—	—	—	—	28	23	3	—
1	850820	1100-1333	"	0	—	—	—	—	—	61	22	9	2	22
2	"	" "	"	"	—	—	—	—	—	29	18	6	2	27
3	"	" "	"	"	—	—	—	—	—	59	16	10	5	0
4	"	" "	"	"	—	—	—	—	—	42	25	9	0	0
5	"	" "	"	"	—	—	—	—	—	155	83	19	0	0
6	"	" "	"	"	—	—	—	—	—	224	107	40	1	0

Appendix C. Data summary for Gull Island during 1986.

Gull Colony Count

Island Gull Date 6/11/86

Nest w/o egg
(Empty) 0 chick 99

1 chick

2 chicks

3 chicks

Nest w/1 egg
0 chick 34

1 chick

2 chicks

Nest w/2 eggs
0 chick 65

1 chick

Nest w/3 eggs 87

Nest w/4 Eggs 1
Total nests 286

Comments

Nesting Attempt Form

Island Gull 1986 Breeding Season

Plot	Date	Time	Vis	Wind	PECO	RFCO	BLKI	GWGU	COMU	PIGU	TUPU
1	860610	1045- —	1	10-15	—	—	77 (44)	4 (2)	27	—	—
1	860714	1100-1530	1	15	—	—	60 (35)	—	18	—	—
2	860610	1100- —	1	10-15	—	—	69 (48)	—	134	—	—
2	860714	1100-1530	1	15	—	—	76 (48)	—	28	—	—
3	860714	" "	1	15	—	—	78 (66)	—	16	—	—
4	860610	1155- —	1	10-15	—	—	60 (40)	—	0	—	—
4	860714	1100-1530	1	15	—	—	46 (37)	—	0	—	—
5	860610	1118- —	1	10-15	—	—	248 (160)	—	3	—	—
5	860714	1100-1530	1	15	1 (0)	—	202 (162)	—	0	—	—
6	860610	1140- —	1	10-15	28 (16)	2 (0)	381 (201)	—	26	—	—
6	860714	1100-1530	1	15	33 (18)	—	259 (214)	—	13	—	—
7	860610	1205- —	1	10-15	2 (2)	—	177 (126)	—	0	—	—
7	860714	1100-1530	1	15	0	0	105 (77)	—	18	—	—

Nesting Attempt Form

Island Gull _____ 1986 Breeding Season

Plot	Date	Time	Vis	Wind	PECO	RFCO	BLKI	GWGU	COMU	PIGU	TUPU
8	860610	1015-—	1	10-15	8(5)	0	116 (76)	—	7	—	—
8	860714	1100-1530	1	15	15(3)	0	101 (73)	—	0	—	—

Reproductive Success Form

Gull Island — 1986 Breeding Season

Plot	Date	Time	Vis	Wind	Pelagic Cormorants Ad	0	1c	2c	3c	Red-faced Cormorants Ad	0	1c	2c	3c	Kittiwakes Ad	0	1c	2c	Common Murre
1	860730	1115- -	1	10-15	0	0	0	0	0	2	0	0	1	0	66	16	21	7	18
1	860731	1215-1500	1	0	1	0	0	1	0	0	0	0	0	0	70	-	-	-	19
1	860801	1230-1400	1	2	-	-	-	-	-	-	-	-	-	-	74	-	-	-	21
1	860802	1310-1415	1	5	-	-	-	-	-	-	-	-	-	-	67	-	-	-	15
1	860804	1210-1227	1	5	1	0	0	0	1	0	0	0	0	0	(40)	-	-	-	18
2	860730	1115-1250	1	10-15	0	0	0	0	0	0	0	0	0	0	62	21	14	3	30
2	860731	1215-1500	1	0	0	0	0	0	0	0	0	0	0	0	59	-	-	-	28
2	860801	1230-1400	1	2	-	-	-	-	-	-	-	-	-	-	37	-	-	-	28
2	860802	1310-1415	1	5	-	-	-	-	-	-	-	-	-	-	39	-	-	-	26
2	860804	1232-1238	1	5	-	-	-	-	-	-	-	-	-	-	(43)	-	-	-	34
3	860730	1115-1250	1	10-15	0	0	0	0	0	0	0	0	0	0	81	8	31	14	46
3	860731	1215-1500	1	0	0	0	0	0	0	0	0	0	0	0	91	-	-	-	22
3	860801	1230-1400	1	2	-	-	-	-	-	-	-	-	-	-	102	-	-	-	2
3	860802	1310-1415	1	5	-	-	-	-	-	-	-	-	-	-	79	-	-	-	8
3	860804	1238-1245	1	5	-	-	-	-	-	-	-	-	-	-	(68)	-	-	-	19

Reproductive Success Form

Gull Island

1986 Breeding Season

Plot	Date	Time	Vis	Wind	Pelagic Cormorants Ad	Pelagic Cormorants @	Pelagic Cormorants 1c	Pelagic Cormorants 2c	Pelagic Cormorants 3c	Red-faced Cormorants Ad	Red-faced Cormorants @	Red-faced Cormorants 1c	Red-faced Cormorants 2c	Red-faced Cormorants 3c	Kittiwakes Ad	Kittiwakes @	Kittiwakes 1c	Kittiwakes 2c	Common Murre
4	860730	1305-1312	1	10-15	0	0	0	0	0	0	0	0	0	0	48	9	19	6	0
4	860731	1215-1500	1	0	0	0	0	0	0	0	0	0	0	0	52	–	–	–	0
4	860801	1230-1400	1	2	–	–	–	–	–	–	–	–	–	–	68	–	–	–	0
4	860802	1310-1415	1	5	–	–	–	–	–	–	–	–	–	–	54	–	–	–	0
4	860804	1326-1328	1	15	–	–	–	–	–	–	–	–	–	–	(38)	–	–	–	–
5	860730	1115-1250	1	10-15	0	0	0	0	0	2	1	0	0	0	185	69	66	21	4
5	860731	1215-1500	1	0	3	1	0	0	0	0	0	0	0	0	201	–	–	–	8
5	860801	1230-1400	1	2	–	–	–	–	–	–	–	–	–	–	247	–	–	–	9
5	860802	1310-1415	1	5	–	–	–	–	–	–	–	–	–	–	219	–	–	–	9
5	860804	1250-1300	1	5	1	1	0	0	0	0	0	0	0	0	(149)	–	–	–	5
6	860730	1250-1304	1	10-15	–	–	–	–	–	–	–	–	–	–	(140) 199	–	–	–	40
6	860731	1251-1500	1	0	38	14	3	4	0	0	0	0	0	0	275	–	–	–	20
6	860801	1230-1400	1	2	–	–	–	–	–	–	–	–	–	–	310	–	–	–	20
6	860802	1310-1415	1	5	–	–	–	–	–	–	–	–	–	–	279	–	–	–	22
6	860804	1315-1325	1	15	–	14	3	6	0	–	–	–	–	–	(223)	–	–	–	23

C-5

Reproductive Success Form

Gull Island — 1986 Breeding Season

Plot	Date	Time	Vis	Wind	Pelagic Cormorants Ad	0	1c	2c	3c	Red-faced Cormorants Ad	0	1c	2c	3c	Kittiwakes Ad	0	1c	2c	Common Murre
7	860730	1313-1328	1	20	–	–	–	–	–	–	–	–	–	–	(78) 118	–	–	–	7
7	860731	1215-1500	1	0	0	0	0	0	0	0	0	0	0	0	157	–	–	–	11
7	860801	1230-1400	1	2	–	–	–	–	–	–	–	–	–	–	189	–	–	–	4
7	860802	1310-1415	1	5	–	–	–	–	–	–	–	–	–	–	142	–	–	–	0
7	860804	1232-1238	1	15	–	–	–	–	–	–	–	–	–	–	(114)	–	–	–	1
8	860730	1329-1343	1	20	–	–	–	–	–	–	–	–	–	–	84	30	25	11	7
8	860731	1215-1500	1	0	11	2	2	1	0	0	0	0	0	0	94	–	–	–	3
8	860801	1230-1400	1	2	0	–	–	–	–	0	–	–	–	–	120	–	–	–	0
8	860802	1310-1415	1	5	–	–	–	–	–	–	–	–	–	–	102	–	–	–	3
8	860804	1155-1205	1	5	12(7)	–	–	–	–	0	–	–	–	–	(80)	–	–	–	0
Gorilla R	860731	—	1	–	0	–	–	–	–	1(1)	–	–	–	–	–	–	–	–	–
Murre R.	"	—	1	–	28(2)	–	–	–	–	8(2)	–	–	–	–	–	–	–	–	–
Gull	"	—	1	–	(81) 191	–	–	–	–	(11) 36	–	–	–	–	–	–	–	–	–
																			0 16

Appendix D. Data summary for Sixty-Foot Rock during 1984.

Nesting Attempt Form

Island Sixty-Foot Rock 1984 Breeding Season

Plot	Date	Time	Vis	Wind	PECO	RFCO	BLKI	GMGU	COMU	PIGU	TUPU
Total Island	840629	1100-1115	1	—	—	—	(199)	—	—	—	—
"	840724	—	—	—	30	—	—	21, 2c	234	—	17
"	840801	—	—	—	—	—	(151)	—	—	—	—

D-1

Nests in parenthesis
c = chicks

Appendix E. Data summary for Sixty-Foot Rock during 1985.

Reproductive Success Form

Sixty-Foot Rock

1985 Breeding Season

Plot	Date	Time	Vis	Wind	Pelagic Cormorants Ad	0	1c	2c	3c	Kittiwakes Ad	0	1c	2c	Common Murre
Total Island	850823	1030-1223	1	—	28	0	0	0	0	—	160	17	0	91
1	"	" "	"	—	—	0	0	0	0	-	11	3	0	0
2	"	" "	"	—	—	0	0	0	0	-	19	2	0	23

Appendix F. Data summary for Sixty-Foot Rock during 1986.

Reproductive Success Form

Sixty-Foot Rock

1986 Breeding Season

Plot	Date	Time	Vis	Wind	Pelagic Cormorants					Red-faced Cormorants					Kittiwakes				Common Murre
					Ad	0	1c	2c	3c	Ad	0	1c	2c	3c	Ad	0	1c	2c	
1	860729	1130-1330	1	5-10	0	0	0	0	0	0	0	0	0	0	(52) 70	20 chicks			0
1	860730	0937-1030	2	5-10	0	0	0	0	0	0	0	0	0	0	71	20	18	7	1
1	860731	1104-1155	1	0	–	–	–	–	–	–	–	–	–	–	64	–	–	–	0
1	860801	1130-1210	1	2	–	–	–	–	–	–	–	–	–	–	55	–	–	–	2
1	860802	1100-1150	1	5	–	–	–	–	–	–	–	–	–	–	47	–	–	–	0
2	860729	1130-1339	1	5-10	0	0	0	0	0	0	0	0	0	0	(23) 31	8 chicks			47
2	860730	0947-1030	2	5-10	0	0	0	0	0	0	0	0	0	0	(23) 37	12	8	3	42
2	860731	1104-1155	1	0	–	–	–	–	–	–	–	–	–	–	39	–	–	–	20
2	860801	1130-1210	1	2	–	–	–	–	–	–	–	–	–	–	35	–	–	–	47
2	860802	1100-1150	1	5	–	–	–	–	–	–	–	–	–	–	30	–	–	–	2
Total Colony	860729	1130-1330	1	5-10	11	20 unidentified cormorants also counted. 0	0	0	0	0	0	0	0	0	(230) 314	93 chicks			162
11	860730	0947-1030	2	5-10	9	10 unidentified cormorants also counted. 0	0	0	0	0	0	0	0	0	(220) 346	58	54	19	185
11	860731	1104-1155	1	0	18	0	0	0	0	0	0	0	0	0	355	–	–	–	43
11	860801	1130-1210	1	2	–	–	–	–	–	–	–	–	–	–	325	–	–	–	99
11	860802	1100-1150	1	5	–	–	–	–	–	–	–	–	–	–	284	–	–	–	7

Counts of Miscellaneous Species

Sixty-Foot Rock Total Counts — 1986 Breeding Season

Date	Double-Crested Cormorants	Glaucous-winged Gulls	Tufted Puffins	Pigeon Guillemots
860729	0	83, 19c	10	0
860730	1	89, 14c	13	1
860731	0	113, 16c	2	2 (1)