Demography of auklets *Aethia* spp. in relation to introduced Norway rats *Rattus norvegicus* at Kiska Island, Aleutian Islands, Alaska in 2008

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Cover photo: Auklet colony on the new lava dome of Sirius Point by ALB.

Executive Summary

We monitored productivity and survival of Least and Crested Auklets, and the abundance and distribution of Norway Rats, at Sirius Point, Kiska Island, Alaska from May-August 2008. Overall, Least Auklet productivity (0.64) was the highest recorded at Kiska in eight years of monitoring (2001-2008), and not significantly different from Buldir (0.70) and Kasatochi (0.61) in 2008. Crested Auklet productivity (0.59) was lower than Buldir (0.83) in 2008. Survival of Least Auklets from 2006-2007 (the most recent estimate) was 0.89, reversing a downward trend seen in recent years. Rat abundance was higher than in 2007, but rats were concentrated in few areas, and had little effect on breeding auklets. No rat prey caches were found in 2008, continuing a six year string (2003-2008) with apparent low impact of rats on auklets. Continued monitoring of auklet demography at Kiska is necessary to further quantify natural variability at this large auklet colony.

Introduction

The large auklet *Aethia* spp. colony at Sirius Point, Kiska Island, Aleutian Islands, Alaska numbers over one million individuals. The effects of scale make estimating, or even observing population-level effects of introduced predators at such a colony challenging at best. Norway rats *Rattus norvegicus* were introduced to Kiska during the military occupations of 1942-1946 (Murie 1959), and likely present a long term threat to the breeding seabirds including auklets (Major et al. 2006). This was our eighth year of monitoring of auklet demography and rat abundance and distribution at Kiska. For further information, see Major et al. (2006) and our website (www.mun.ca/serg/Kiska2002.html). Our cumulative observations have shown that when rat abundance is high, auklet productivity is low, but rat abundance is for some unknown reason highly variable and unpredictable across years. Only long-term demographic monitoring will indicate whether auklets and rats are in stable coexistence at Kiska.

In summary, the objectives of our study were: 1) to quantify Least (*Aethia pusilla*) and Crested Auklet (*A. cristatella*) productivity from representative areas of the Sirius Point colony for the 2008 breeding season, 2) to identify causes of auklet breeding failure (especially if involving rats), 3) to quantify Least Auklet adult survival at one representative study plot for 2001-2008 (again assessing possible effects of rats), 4) redeploy a rat monitoring transect protocol to quantify inter-year variation in relative abundance of rats at Sirius Point, and 5) identify the remaining key questions about rat impacts on seabirds at Kiska.

Methods

Auklet Productivity

Least and Crested Auklet productivity was measured at Sirius Point, Kiska Island (52°08'N 177°37'E) using standardized United States Fish and Wildlife Service (USFWS) protocols (AMNWR 2000). Any failed crevice was closely examined to determine the cause of failure, including whether rat predation was responsible. These data were compared to similar data collected at auklet colonies at Buldir (52°23'N 175°55'E) and Kasatochi Islands (52°11'N 175°31'W) using the same protocol. Buldir and Kasatochi have no rats, and act as a useful comparison to Sirius Point in determining the effect of rats on auklet productivity. We used three plots to estimate productivity (New Lava, Old Lava Low and Old Lava High), and these are believed to be representative of the auklet colony at present (Jones et al. 2001, Major et al. 2006). We used a generalized linear model in SPSS 16 to examine differences among plots and among islands. Values were considered significant when $p < 0.05$.

Auklet Survival

Least Auklet adult interannual survival was measured using previously described field protocols (Jones 1992, Jones et al. 2002, Jones et al. 2004) and program MARK (White and Burnham 1999). The survival plot is thought to be representative of the colony (Jones et al. 2001), but this has not been tested. Each captured adult individual was banded with a FWS stainless steel band on its right leg and fitted with a unique combination of Darvik plastic colour bands (two on left leg, one on right leg) as described by Jones et al. (2001). Resightings of banded birds occurred during peak auklet activity (approximately 0945-1530 hrs and 2300-0000 hrs) from 27 May to 26 July 2008.

Adult interannual survival estimates up to the period 2006-2007 are presented here, as the 2007-2008 survival estimate will not be available until 2009. Amongst our candidate models were those that included a 'transient effect' of marked individuals leaving the study area following banding (model C $\{\phi_{(Year1+t)}\ p_{(t)}\}$), and time-dependent (t) and time-independent (.) models of both survival and encounter probability (Table 8). Model selection was based on quasi-likelihood adjusted Akaike's Information Criteria ($QAIC_c$).

Norway Rat Abundance and Distribution

Because snap-trapping is not feasible at Sirius Point (too many auklets), detection using chew marks at stations set across the auklet colony was recommended (Eggleston and Jones 2006). Following this protocol, wax blocks were set at the same stations and along the same transect lines used by Eggleston and Jones (2006) and Bond and Jones (2007). Eighty stations (8 transects of 10 stations 25m apart) covered representative habitat types of the Sirius Point auklet colony. Two replicate monitoring trials were carried out, with one during 09-15 June and another during 09-15 July. One station was not monitored in June as it was still under snow cover. Differences among plots or between months were tested using a generalized linear model, with p-values < 0.05 considered significant.

Additional Observations

A list of bird species identified from 25 May – 05 August is presented in Appendix I, and a summary of Norway rat sign observations is in Appendix II. Throughout the season, attempts were made to document all bird species that may be breeding at Sirius Point, either by finding a nest or fledged young.

Results

Least Auklet Productivity

There was no difference among plots in Least Auklet hatching success ($\chi^2 = 0.17$, p = 0.92, df = 2), or fledging success ($\chi^2 = 0.05$, p = 0.98, df = 2), so data were pooled. Overall, 156 Least Auklet crevices were monitored yielding a hatching success of 0.83, a fledging success of 0.77 and overall reproductive success of 0.64. Further details are in Table 1.

Across Islands (Buldir, Kiska and Kasatochi), there was no significant difference in hatching success ($\chi^2 = 1.45$, p = 0.45, df = 2) or fledging success ($\chi^2 = 1.39$, p = 0.50, df = 2). See Table 2 for a full comparison.

Crested Auklet Productivity

There was no difference among plots in Crested Auklet hatching success ($\chi^2 = 1.09$, p = 0.58, df = 2) or fledging success ($\chi^2 = 0.49$, p = 0.79, df = 2), so data were pooled. A total of 29 crevices were monitored, and had a hatching success of 0.79, a fledging success of 0.74 and overall reproductive success of 0.59. Further details are in Table 3.

There was no difference in hatching success ($\chi^2 = 1.92$, p = 0.38, df = 2), but fledging success did differ across islands ($\chi^2 = 6.42$, p = 0.04, df = 2), with Buldir having significantly higher fledging success than Kiska (p = 0.018).

Least Auklet Survival

The model that best fit the data was one with survival and resight probability varying across years, but with no transient effect. The models tested are shown in Table 6 and estimates of

survival and resight probability are presented in Table 7. Survival for 2006-2007 was 0.89, the highest since 2002-2003, while the resight probability for 2007 was 0.85.

Norway Rat Abundance and Distribution

There was no difference in wax block hits between June and July ($\chi^2 = 1.06$, $p = 0.30$, $df = 1$), nor was the month-plot interaction significant ($\chi^2 = 1.17$, $p = 0.76$, $df = 3$), so both months were pooled. There were significant differences among plots ($\chi^2 = 14.07$, $p = 0.003$, $df = 3$), with more rat detections in the Gullies than on the other three transects ($\chi^2 = 10.51$, $p = 0.001$, $df = 1$). A total of 37 hits were recorded, up from one hit in 2007 (Table 8).

Discussion

Productivity

Least Auklet productivity was the highest since monitoring began in 2001, and was higher than that recorded in 2007 despite the measured increase in rat abundance (Fig. 1). That there was no difference among the three plots in hatching or fledging success despite the large differences in rat abundance is curious. This suggests that rats, while abundant in general, chose alternate prey consisting of auklets from unmonitored crevices. A systematic spatial examination of reproductive success/failure is in progress.

There was no difference in Least Auklet productivity across islands, which would seem to implicate large-scale climatic influences rather than more local effects (including predators such as rats and gulls), in determining productivity in 2008. That there was no difference in productivity even with higher rat abundance at Kiska suggests that there is no effect of rats

below a threshold level (such as observed in 2001-2002) not exceeded in 2008, or that the relationship is masked by other factors, such as climate and oceanography.

Crested Auklet productivity was lower on Kiska than Buldir, although the sample size on Kiska is relatively small, so this must be interpreted with caution. Most monitored Crested Auklet crevices on Kiska are on the Old Lava High and Old Lava Low plots, which did not have any rats detected on them. This suggests a clearer link between productivity and local climatic influences as opposed to either rats or large-scale oceanography.

Survival

Least Auklet survival estimates for 2006-2007 reversed the trend observed in the previous few years of a steady decline (Fig. 2). The survival estimate was the highest since 2002-2003 (0.94), and is above the average from 1990-2000 on Buldir (Jones et al. 2002). A large number of subadults were observed in 2007 (Bond and Jones 2007) and in 2008, with these peaking early in the season. This suggests continued high over-winter survival for 2007-2008, although the estimate for this is unavailable until 2009. Since 2007 was also the lowest rat abundance recorded (Bond and Jones 2007), we may expect a decline in adult survival for 2008.

Norway Rat Abundance and Distribution

Rats were more abundant in 2008 than in 2007, but not as abundant as 2006 (Table 8). Interestingly, we found no prey caches this year, partly a factor of the amount of time spent searching, yet coverage has been high in recent years due to the extensive hiking demanded by the rat transect survey protocol. Large prey caches have not been found at Sirius Point since 2002 when rats were abundant. In 2008, rats were not detected on transects on Old Lava Low or

Old Lava High, but we believe that rats will eventually occupy these areas into the autumn. Upon our arrival in late May, snow covered many auklet crevices on Old Lava High, suggesting a late spring. An immaculate wax block left at the top of the Old Lava Low transect in July 2007 was relocated in June 2008, and had many chew marks, suggesting that rats move further inland and further up in elevation after the second series of transects done in mid-July.

The most concentrated rat presence was in Glen Curly, and at the western-most transect stations of Glen Larry; very few detections were in the part of Glen Larry adjacent to camp or on New Lava. And although there was no significant difference in the number of detections between June and July, the trend of more detections later in the season follows from previous years' data (Table 8).

Additional Observations

There was only one Glaucous-winged Gull (*Larus glaucescens*) nest near camp this year, and it was above Parakeet Point. Two chicks fledged. The three nest-sites used on 2007 were not used this year.

Winter Wrens (*Troglodytes troglodytes*) seemed more abundant in 2008 than in 2007, although no systematic surveys were conducted. Unfortunately, four were caught and killed in snap traps set around camp, and two drowned in insect pit-fall traps deployed for the University of Alaska Museum of the North.

Song Sparrows (*Melospizia melodia*) did not breed at Sirius Point in 2008, but up to three individuals were seen together in late July / early August.

For the second year in a row, a large number of fledgling Least Auklets and smaller numbers of Crested Auklets were found dead in Glen Larry in what we believe to be a toxic gas vent.

This is the area of the birds presumed killed by wind in 2007 (Bond and Jones 2007). We will work with the U.S. Geological Survey in 2009 to sample and identify the gaseous emissions from these two sites. Other dead specimens included a juvenile Peregrine Falcon *Falco peregrinus* and the second North American record of Brown Hawk Owl *Ninox scutulata* (see: http://www.mun.ca/serg/brownhawkowl.html).

There was considerably more snow in 2008 than in 2007, and throughout June and into mid-July, auklets could be seen standing on snowfields above the Old Lava High Plot. One rat transect station at 406' elevation was covered by snow during the first series of wax block detections on 09-15 June.

Conclusions and Recommendations

1. In 2008, Least Auklet survival and productivity were high despite a low but slightly increased abundance of Norway rats compared with 2007. Adult annual survival has apparently rebounded from alarmingly low levels during 2003-2006.
2. Our third year of quantitative surveys showed that rats were more abundant near Sirius Point than in 2007, but less than 2006, highlighting their erratic population trends. Rats remain scarce relative to the high numbers observed in 2001 and 2002.
3. The continued monitoring of auklets and rats at Sirius Point is needed to understand the natural fluctuations in this dynamic system.

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References

AMNWR. 2000. Monitoring productivity, chick growth, and food habits at Buldir and Kasatochi Islands. Procedure No. 23. Aleutian Islands Unit, Alaska Maritime National Wildlife Refuge, Homer, AK.

Bond, A.L. and Jones, I.L. 2007. Survival and productivity of auklets (*Aethia* spp.) at Sirius Point, Kiska Island in 2007 in relation to the abundance and distribution of introduced Norway rats (*Rattus norvegicus*). Unpublished report. Alaska Maritime NWR, Homer, AK.

Eggleston, C.J. and Jones, I.L. 2006. Assessing the effects of Norway rats on auklet breeding success and survival at Sirius Point, Kiska Island, Alaska in 2006. Unpublished report. Alaska Maritime NWR, Homer, AK.

Jones, I.L. 1992. Factors affecting survival of adult Least Auklets (*Aethia pusilla*) at St. Paul Island, Alaska. Auk 109:576-584.

Jones, I.L., Gray, C.M., Dusureault, J. and Sowls, A.L. 2001. Auklet demography and Norway rat distribution and abundance at Sirius Point, Kiska Island, Aleutian Islands, Alaska in 2001. Unpublished report. Alaska Maritime NWR, Homer, AK.

Jones, I.L., Hunter, F.M. and Robertson, G.J. 2002. Annual adult survival of Least Auklets (Aves, Alcidae) varies with large-scale climatic conditions of the North Pacific Ocean. Oecologia 133:38-44.

Jones, I.L., Hunter, F.M., Robertson, G.J. and Fraser, G.S. 2004. Natural variation in the sexually selected feather ornaments of Crested Auklets (*Aethia cristatella*) does not predict future survival. Behav. Ecol. 15:332-337.

Major, H.L., Jones, I.L., Byrd, G.V. and Williams, J.C. 2006. Assessing the effects of introduced Norway rats (*Rattus norvegicus*) on survival and productivity of Least Auklets (*Aethia pusilla*). Auk 123:681-694.

Murie, O.J. 1959. Fauna of the Aleutian Islands and Alaska Peninsula. N. Am. Fauna 61:1-364.

White, G.C. and Burnham, K.P. 1999. Program MARK: survival estimation from populations of marked animals. Bird Study 46:120-138.

Table 1. Least Auklet productivity and known causes of breeding failure as measured from three plots at Sirius Point, Kiska Island, Alaska in 2008.

	Lava Dome	Old Lava 'Low'	Old Lava 'High'	Kiska Total
Crevices monitored, n (a)	74	33	49	157
Number hatched (b)	62	28	40	132
Egg abandoned	3	0	0	3
Egg disappeared	4	5	8	17
Egg broken	2	0	1	3
Egg predated	3	0	0	3
Egg displaced	0	0	0	0
Crevice collapse	0	0	0	0
Dead adult in crevice	0	0	0	0
Number fledged (c)	48	21	32	101
Small dead chick	1	0	0	1
Chick disappeared	14	7	8	29
Chick predated	0	0	0	0
Large dead chick	0	0	0	0
Hatching success (b/a)	0.84	0.82	0.85	0.84
Fledging success (c/b)	0.76	0.80	0.75	0.77
Reproductive success (c/a)	0.64	0.65	0.64	0.64

Table 2. Least Auklet productivity from plots on Kiska, Buldir and Kasatochi in 2008.

	Lava Dome	Old Lava 'Low'	Old Lava 'High'	Kiska Total	Buldir[1]	Kasatochi[2]
n (a)	75	33	49	157	67	98
Number hatched (b)	64	28	40	132	57	77
Number fledged (c)	48	21	32	101	47	60
Hatching success (b/a)	0.84	0.82	0.85	0.84	0.85	0.78
Fledging success (c/b)	0.76	0.80	0.75	0.77	0.83	0.78
Reproductive success (c/a)	0.64	0.65	0.64	0.64	0.70	0.61

1: Payne 2008, 2: Buchheit and Ford 2008.

Table 3. Crested Auklet productivity and known causes of breeding failure as measured from three plots at Sirius Point, Kiska Island, Alaska in 2008.

	Lava Dome	Old Lava 'Low'	Old Lava 'High'	Kiska Total
Crevices monitored, n (a)	4	10	15	29
Number hatched (b)	3	9	11	23
Egg abandoned	0	0	0	0
Egg disappeared	1	1	4	6
Egg broken	0	0	0	0
Egg predated	0	0	0	0
Egg displaced	0	0	0	0
Crevice collapse	0	0	0	0
Dead adult in crevice	0	0	0	0
Number fledged (c)	0	6	11	17
Small dead chick	0	1	0	1
Chick disappeared	3	1	0	4
Chick predated	0	0	0	0
Large dead chick	0	0	0	0
Crevice collapse	0	1	0	1
Hatching success (b/a)	0.75	0.90	0.73	0.79
Fledging success (c/b)	0.00	0.67	1.00	0.74
Reproductive success (c/a)	0.00	0.60	0.73	0.59

Table 4. Crested Auklet productivity from plots at Sirius Point, Kiska Island, , Buldir and Kasatochi in 2008.

	Lava Dome	Old Lava 'Low'	Old Lava 'High'	Kiska Total	Buldir[1]	Kasatochi[2]
n (a)	4	10	15	29	75	109
Number hatched (b)	3	9	11	23	66	97
Number fledged (c)	0	6	11	17	62	84
Hatching success (b/a)	0.75	0.90	0.73	0.79	0.88	0.89
Fledging success (c/b)	0.00	0.67	1.00	0.74	0.94	0.87
Reproductive success (c/a)	0.00	0.60	0.73	0.59	0.83	0.77

1: Payne 2008, 2: Buchheit and Ford 2008.

Table 5a. Number of Least Auklets banded at Sirius Point, Kiska Island, Alaska from 2001-2008.

Year	Newly banded adults	Newly banded subadults	Within-year recaptures	Between-year recaptures	Total Captures
2001	198	36	36	-	270
2002	20	1	0	5	26
2003	12	0	0	14	26
2007	114	12	22	20	168
2008	125	56	12	33	226
Total	**469**	**105**	**70**	**72**	**616**

Table 5b. Number of Crested Auklets banded at Sirius Point, Kiska Island, Alaska from 2001-2008.

Year	Newly banded adults	Newly banded subadults	Within-year recaptures	Between-year recaptures	Total Captures
2001	23	4	2	-	29
2002	1	0	0	0	1
2003	6	0	0	0	6
2007	23	2	1	1	27
2008	41	9	4	6	60
Total	**94**	**15**	**7**	**7**	**123**

Table 6. Comparison of CMR models from program MARK for Least Auklets at Sirius Point, Kiska Island, Alaska from 2001-2007, where ϕ is survival, p is the encounter probability and t is time. Adjusted for c-hat = 2.785.

Model	$QAIC_c$	$\Delta QAIC_c$	QAIC Weight	Model Likelihood	# Parameters	Deviance
A $\{\phi_{(t)}\ p_{(t)}\}$	533.095	0	0.840	1.000	13	56.295
B $\{\phi_{(.)}\ p_{(t)}\}$	537.124	4.03	0.112	0.133	8	70.547
C $\{\phi_{(Year1+t)}\ p_{(t)}\}$	538.812	5.72	0.048	0.057	13	63.013
D $\{\phi_{(t)}\ p_{(.)}\}$	554.514	21.42	<0.001	0.000	8	87.941
E $\{\phi_{(.)}\ p_{(.)}\}$	565.591	32.50	<0.001	0.000	2	111.147

Table 7. Least Auklet survival at Sirius Point, Kiska Island, Alaska - estimates (ϕ) and encounter probabilities (p) for 2001-2007 as determined by model A from program MARK with confidence intervals adjusted for c-hat = 2.785.

			95% Confidence Interval	
Parameter	Estimate	Standard Error	Lower	Upper
$\phi_{2001\text{-}2002}$	0.901	0.037	0.803	0.954
$\phi_{2002\text{-}2003}$	0.942	0.032	0.835	0.981
$\phi_{2003\text{-}2004}$	0.808	0.054	0.681	0.892
$\phi_{2004\text{-}2005}$	0.754	0.099	0.518	0.897
$\phi_{2005\text{-}2006}$	0.721	0.105	0.482	0.878
$\phi_{2006\text{-}2007}$	0.889	0.082	0.610	0.976
p_{2002}	0.926	0.034	0.825	0.971
p_{2003}	0.951	0.030	0.844	0.986
p_{2004}	0.929	0.043	0.785	0.979
p_{2005}	0.488	0.092	0.316	0.662
p_{2006}	0.831	0.074	0.636	0.933
p_{2007}	0.855	0.083	0.613	0.956

Table 8. Summary of Norway rat activity at eight wax block transect stations from 2006-2008 at Sirius Point, Kiska Island.

	June			July					
Year	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	June Total	July Total	Grand Total
2006	7	6	6	21	27	27	19	75	94
2007	0	0	0	0	1	0	0	1	1
2008	2	3	7	5	6	14	12	25	37

Figures

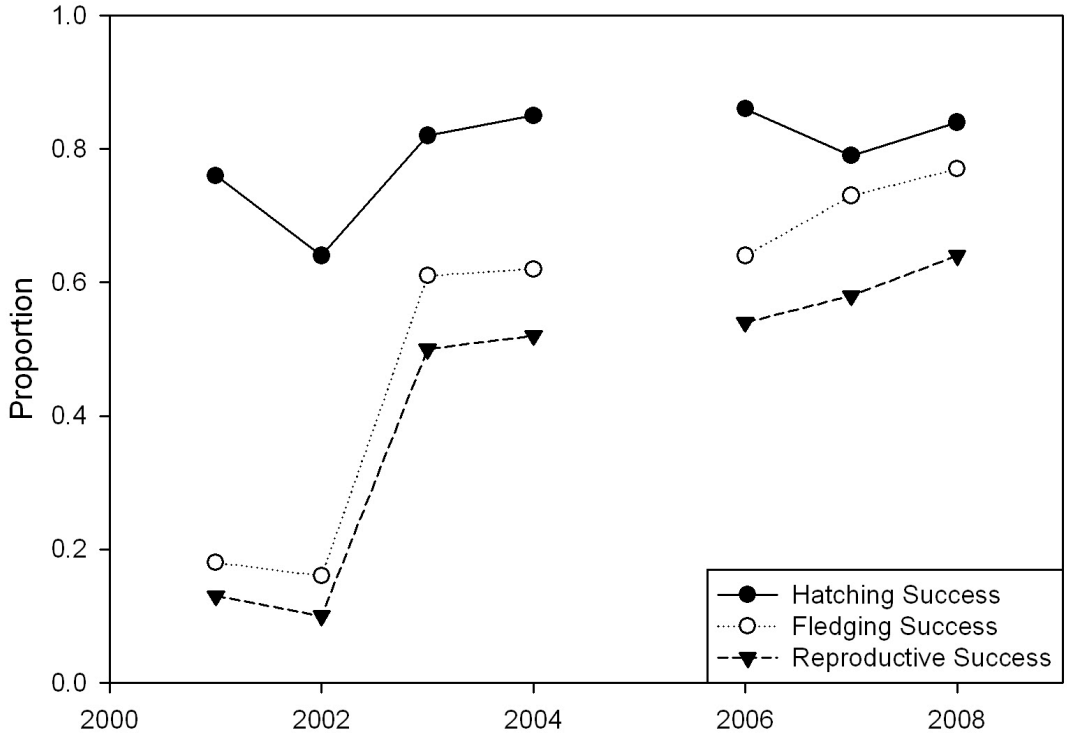

Figure 1. Hatching, fledging and overall reproductive success of Least Auklets at Sirius Point, Kiska Island, Alaska from 2001-2008.

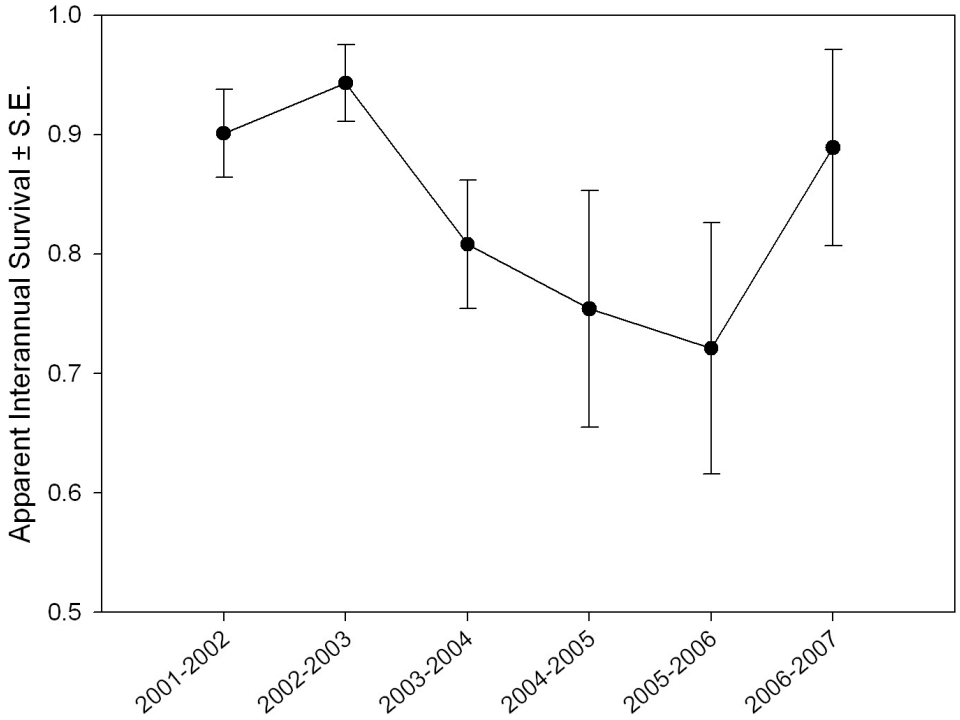

Figure 2. Apparent interannual survival probabilities for Least Auklets at Sirius Point, Kiska Island, Alaska from 2001-2007 as estimated by model A (Table 7) from program MARK.

Appendix I. List of birds recorded at Sirius Point in 2008. Confirmed or suspected breeding species are indicated in boldface.

Aleutian Cackling Goose *Branta hutchinsii leucopariea* – Large flocks frequently observed over Sirius Point and roosting on the south side of Kiska Volcano (nested in 2007 south of West Kiska Lake).

Tundra Swan *Cygnus colombianus* – One seen at Christine Lake on 04 June, nested at the Lake District in 2007.

Common Eider *Somateria mollissima* – Both males and females present at Sirius Point on three occasions through the summer.

Green-winged Teal *Anas crecca* – Common at Christine Lake.

Greater Scaup *Aythya marila* – Common at Christine Lake.

Common Merganser *Mergus merganser* – A few were observed at Christine Lake, possible *merganser* subspecies (Old World Goosander).

Red-breasted Merganser *Mergus serrator* – Uncommon at Christine Lake

Laysan Albatross *Phoebastria immutabilis* – Uncommon off Sirius Point.

Short-tailed Shearwater *Puffinus teniurostris* – Uncommon off Sirius Point.

Northern Fulmar *Fulmaris glacialis* – Uncommon off Sirius Point.

Fork-tailed Storm-petrel *Oceanodroma furcata* – Uncommon at Sirius Point, heard occasionally at night from camp. Suspected breeder; breeds on Little Kiska?

Pelagic Cormorant *Phalacrocorax pelagicus* – Common, breeds locally.

Red-faced Cormorant *Phalacrocorax urile* – Uncommon, breeds locally.

Bald Eagle *Haliaeetus leucocephalus* – Common breeder.

Peregrine Falcon *Falco peregrinus* – Uncommon local breeder.

Rock Ptarmigan *Lagopus mutus* – Common on volcano slopes.

Wood Sandpiper *Tringa gareola* – Uncommon breeder at Christine Lake.

Black-legged Kittiwake *Rissa tridactyla* – Common, breeds locally.

Glaucous-winged Gull *Larus glaucescens* – Common, breeds locally

Common Murre *Uria aalge* – Uncommon off Sirius Point, breeds locally

Thick-billed Murre *Uria lomvia* – Both species breed locally (Pillar Rock.

Pigeon Guillemot *Cepphus columba* – Rare, off Sirius Point (breeds locally?).

Parakeet Auklet *Aethia psittacula* – Uncommon breeder at Sirius Point.

Least Auklet *Aethia pusilla* – Abundant breeder at Sirius Point.

Crested Auklet *Aethia cristatella* – Abundant breeder at Sirius Point.

Horned Puffin *Fratercula corniculata* – Rare off Sirius Point.

Tufted Puffin *Fratercula cirrhata* – Uncommon off Sirius Point, breeds locally (Wolf Point and Little Kiska).

Brown Hawk Owl *Ninox scutulata* – One carcass found in Glen Larry on 01 August. This represents the second North American record for this species, and the first in the Aleutians (the other was at St. Paul Island in September 2007).

Common Raven *Corvus corax* – Two birds occasionally at Sirius Point.

Winter Wren *Troglogytes troglodytes* – Common breeder, more abundant than in 2007, especially in late July/early August.

Song Sparrow *Melospiza melodia aleutica* – One adult seen at Witchcraft Point on 02 June and up to three seen at Sirius Point in late July.

Lapland Longspur *Calcarius lapponicus* – Common in alpine meadows, at Christine Lake, and on the old lava flow.

Snow Bunting *Plectrophenax nivalis* – Uncommon breeder.

Gray-crowned Rosy-finch *Leucosticte tephrocotis* – Common breeder.

Appendix II. Summary of Norway rat signs observed at Sirius Point in 2007 (LeAu: Least Auklet; CrAu: Crested Auklet).

Date	Location	Comments
May-August	Camp	Fresh tracks almost daily near camp, especially noticeable after rain events or heavy fog
27 May	Camp	Arrival, some droppings in cabin
29 May	Glen Curly	2 adult LeAu and 2 LeAu eggs
29 May	Camp	adult LeAu
01-05 June	Christine Lake	Few rat tracks because of no sand on beaches; several rat holes found along the berm.
03 June	Christine Lake	Rat caught in snap trap
06 June	New Lava	2 LeAu eggs
06 June	Camp	Rat detected on night-vision camera
09 June	Glen Curly	adult LeAu
10 June	Glen Curly	2 LeAu eggs
12 June	Glen Larry	adult LeAu
12-15 June	Sirius Point	Rat transects, 12 hits
18 June	Camp	Rat caught in snap trap
19 June	Camp	Rat caught in snap trap
20 June	Camp	Rat caught in snap trap
22 June	Camp	Rat caught in snap trap
26 June	Camp	2 rats caught in snap traps
27 June	New Lava	Two productivity crevices with depredated LeAu eggs
27 June	Camp	2 rats caught in snap traps
29 June	Camp	Rat caught in snap trap
09 July	Camp	Rat detected no night-vision camera
12-15 July	Sirius Point	Rat transects, 25 hits
15 July	Glen Larry	CrAu egg
19 July	I-can Beach	CrAu egg
21 July	Camp	2 rats caught in snap traps
22 July	Camp	Rat caught in snap trap
25 July	Camp	Rat caught in snap trap
26 July	Camp	Rat caught in snap trap
01 August	Camp	Rat caught in snap trap