



Coastal Observations of Seabird Mortality in Katmai National Park, Alaska

2012–2021

Natural Resource Report NPS/KATM/NRR—2023/2563





ON THIS PAGE

A common murre colony in the Gulf of Alaska.
NOAA

ON THE COVER

The remains of several common murre carcasses found during a 2016 survey at Swikshak. Each carcass is tagged with an individually identifiable band.
NPS

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Abstract

In 2012, Katmai National Park & Preserve joined the stranded seabird survey efforts spearheaded by the University of Washington's Coastal Observation and Seabird Survey Team (COASST). COASST is a citizen science network started in 1999 with the goal of establishing a baseline dataset of seabird mortality to identify unusual die-offs. During the winter of 2015 and spring of 2016, the Gulf of Alaska experienced a large die-off of common murres (*Uria aalge*; COMU) due to a severe marine heatwave in the North Pacific. Katmai National Park & Preserve (KATM) staff contributed to the identification and documentation of seabird carcasses washed ashore from this die-off; in 2016 alone, 90 murres (likely COMU; only counting new birds) were documented along a 1 km stretch of Swikshak beach. KATM staff have conducted a total of 105 COASST surveys documenting 203 seabird carcasses on four 1 km section of beaches in KATM and Bristol Bay: Swikshak, Hallo, North Hallo, and Naknek. During the peak of the die-off in 2016, Swikshak beach contained an average of 20.6 carcasses per survey. During a typical year (using 2014 as an example), the average was 0.33 carcasses, highlighting the severe impact that die-off events like this have on seabird colonies. These events have occurred throughout Alaska annually since 2015 (USFWS 2021) and have affected some of our beaches every year, particularly Naknek Beach in 2019.

Introduction

Contributing to the biodiversity at Katmai National Park and Preserve (KATM) are 35 species of seabirds (www.nps.gov/katm) that use the coast for breeding and raising their young. Seabirds play an important role in the coastal marine system. They are an important food source for various terrestrial and marine predators and their guano serves as a fertilizer in marine systems. Seabirds are also an indicator for ecosystem health due to their position in the trophic web. When there are seabird die-off events, scientists are alerted to potential changes in the environment and can look for causes.

Numerous species of colonial nesting seabirds experience periodic die-offs (also known as wrecks) for a variety of reasons. During the winter of 2015 and the spring of 2016, the Gulf of Alaska experienced a large die-off of common murres. This was attributed to a severe marine heatwave; the greatest on record since the 1980s (Bond et al. 2015) that began in this region in late 2013 and spread to a large portion of the northeast Pacific Ocean. This caused massive declines in forage fish availability, leading to widespread starvation and reproductive failure among murre colonies. Around 47,000 carcasses were encountered in Alaska, with an estimate of 1,030,000 total birds (25% of the breeding population of this species) died in the Gulf of Alaska during this heatwave event (Piatt et al. 2020). The common murre die-off event was first documented by the Southwest Alaska Network (SWAN) in KATM during a winter bird survey in 2016. From March 14–19, 2016, SWAN counted 2,036 dead birds on 21 beaches in KATM. 98% (n=1,988) of those carcasses were identified to the murre family, and 100% (n=35) of birds identified at the species level were common murres (Kaler et al. 2016). Similar die-off events have occurred throughout Alaska annually since 2015.

KATM has partnered with the University of Washington (UW) to monitor and record the incidence of seabird mortality within the park as part of UW's citizen science project called the Coastal Observation and Seabird Survey Team (COASST). COASST has participating federal and state agencies, nonprofits, and individuals in Alaska, British Columbia, Washington, Oregon, and California. COASST's goal is to establish a baseline dataset of seabird mortality to identify unusual die-offs or effects on seabirds from other causes of mortality. This report summarizes the results of the beached seabird survey efforts conducted in and around KATM from 2012–2021.

Methods

Per the COASST protocol (COASST 2016), surveys at KATM were attempted once a month during the summer and early fall but have been conducted as early as April and as late as November. The survey sites at KATM are remote and are only reachable by small plane, thus, the ability to conduct surveys depended on weather and plane availability. The Swikshak, Hallo Bay, and North Hallo sites are all within the boundaries of KATM and situated on the southeast side of the Aleutian Range, directly across the Shelikof Strait from the Kodiak archipelago (Appendix). The cold oceanic waters of this region support a diverse and productive ecosystem (Heymans et al. 2007), making it an ideal location for seabirds to forage and reproduce.

The Naknek Beach survey site is situated on the coast of Bristol Bay, just northwest of the town of Naknek (Appendix A). The Naknek High School has partnered with the National Park Service (NPS) and COASST to participate in survey efforts at this location to provide educational opportunities for students in the community. Their participation also gives the community insight into possible seabird mortality events occurring in the Bering Sea. Naknek Beach is typically surveyed in the summer months by the NPS staff, and fall and spring months by Naknek High School.

COASST surveys were conducted between 2012 and 2021, generally by a pair of surveyors walking a predetermined 1 km stretch of coastline, searching for dead and dying seabirds washed up on the beach (COASST 2016). The 1 km transect would be walked along the wrack line higher up on the beach then at the end of the 1 km transect the surveyors turned around and walked the same transect back walking lower on the beach to ensure entire beach coverage within that transect. Seabird carcasses found on the survey transect were identified to species and genus using the COASST field guide, using an intact foot, wing, or bill. Once a carcass was found and identified, it was tagged with a colored or wooden tag with a number on it (Figures 1 and 2). In following surveys, if the same carcass was found, it could be identified by the tag and documented as a re-find.



Figure 1. NPS staff Kelsey Griffin and Isaac Kelsey identifying and tagging a seabird carcass at Naknek beach. [NPS photo]



Figure 2. Five seabird skulls found near each other during a COASST survey conducted at Hallo (North). Although the skulls have deteriorated, the unique color bands allow us to identify them as a murre carcass we have previously tagged. [NPS photo]

Results

Beached seabirds have been found at all four COASST survey sites from 2014–2021 (no carcasses found in 2012 or 2013) with a total of 203 new carcasses, majority (51.7%, $n=105$) of which came from 2016. Of the total seabird carcasses found, 13 unique species were identified and 51.7% ($n=105$) were keyed out to the Alcid family. Within this family, the largest constituent was murres, comprising 90.5% ($n=95$) of the total Alcid carcasses found. The highest rate of new seabird carcasses discovered occurred at the Swikshak location, with the majority (86.5%, $n=90$) of those were identified as murres (Table 1).

The contrast between carcass encounter rate in non die-off years (e.g., 2012–2014) and die-off years is evident in both the Gulf of Alaska and Bristol Bay (Figure 3). For example, the average encounter rate at Swikshak was 0.33 birds/km in 2014, and was 20.6 birds/km in 2016 after the major 2015 marine heat wave. Naknek Beach had an average encounter rate of 0.43 birds/km in 2014 and 7.14 birds/km in 2019 during another die-off event in Bristol Bay that year.

At the Naknek Beach survey site, we found a total of 79 beached birds (plus 11 re-find events) between 2014–2021, which included black-legged kittiwakes (*Rissa tridactyla*), fork-tailed storm petrels (*Oceanodroma furcata*), glaucous-winged gulls (*Larus glaucescens*), and short-tailed shearwaters (*Puffinus tenuirostris*; Table 2). There was a sharp increase in the number of new birds (primarily short-tailed shearwaters) found on Naknek Beach in 2019; this is likely correlated with a large die-off event in July of that year in which ~5,400 short-tailed shearwater carcasses were documented in the greater Bristol Bay region (USFWS 2019).

We learned through analysis of re-find identification tags that seabird carcass persistence rates vary greatly between the survey sites within KATM. The die-off was most evident in Swikshak in summer 2016 where carcasses persisted for months. All confirmed tag re-find birds from 2014 and onward occurred at the Swikshak and Naknek survey sites ($n=264$ and $n=11$, respectively) while both the Hallo and North Hallo sites had none. The majority (94.5%, $n=260$) of these re-find events occurred in 2016 and 2017 (Figure 4) and were identified as tags placed on birds from the 2015/2016 die-off.

Table 1. Total number of seabird carcasses identified by species and survey year at each COASST survey location in Katmai National Park from 2014–2021 (no carcasses found in 2012 or 2013). This total does not include re-found, or previously banded, carcasses. (Note: not all years had equal survey effort due to limitations accessing field sites.).

Year	Beach	Black-legged Kittiwake	Common Murre	Fork-tailed Storm Petrel	Glaucous-winged Gull	Horned Puffin	Large Alcids	Mew Gull	Murres	Northern Fulmar	Pigeon Guillemot	Short-tailed Shearwater	Small Alcids	Unknown	Waterfowl (Diving Ducks)	TOTAL
2014	Naknek	0	0	0	1	0	0	2	0	0	0	0	0	0	0	3
	Swikshak	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
2015	Hallo	3	0	0	0	0	0	0	3	0	0	0	0	0	0	6
2016	N Hallo	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
	Swikshak	0	6	0	0	0	2	0	84	0	0	0	8	3	0	103
2017	Hallo	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2
	N Hallo	0	0	1	0	0	0	0	0	1	0	0	0	1	0	3
	Naknek	3	0	0	0	0	0	0	0	0	0	8	0	3	0	14
2018	N Hallo	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	Naknek	1	0	2	0	0	0	0	0	0	0	0	0	0	0	3
2019	Hallo	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
	N Hallo	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	Naknek	2	0	1	0	0	0	0	0	0	0	47	0	0	0	50
2020	Hallo	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2
	N Hallo	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2021	Naknek	2	0	0	0	0	0	0	0	0	0	7	0	0	0	9

Table 2. Summary data collected from the Naknek Beach COASST survey site from 2014–2021, including the total number of surveys, species found, whether these birds were new or re-finds, and the total number of birds found each year.

Year	Species	New	Resighted	Total Birds	Surveys	Carcasses ÷ Survey
2014	Glaucous-winged gull	1	1	2	–	–
	Mew gull	2	0	2	–	–
	Total	3	1	4	7	4 ÷ 7 = 0.571428571
2015	Glaucous-winged gull	0	2	2	–	–
	Total	0	2	2	3	2 ÷ 3 = 0.666666667
2016	N/A	0	0	0	–	–
	Total	0	0	0	3	0 ÷ 3 = 0
2017	Black-legged kittiwake	3	0	3	–	–
	Short-tailed shearwater	8	1	9	–	–
	Not Specified	3	5	8	–	–
	Total	14	6	20	5	20 ÷ 5 = 4
2018	Black-legged kittiwake	1	0	1	–	–
	Fork-tailed storm petrel	2	0	2	–	–
	Total	3	0	3	3	3 ÷ 3 = 1
2019	Black-legged kittiwake	2	0	2	–	–
	Fork-tailed storm petrel	1	0	1	–	–
	Short-tailed shearwater	47	1	48	–	–
	Total	50	1	51	7	51 ÷ 7 = 7.285714286
2020	N/A	0	0	0	–	–
	Total	0	0	0	6	0 ÷ 6 = 0
2021	Black-legged kittiwake	2	1	3	–	–
	Short-tailed shearwater	7	0	7	–	–
	Total	9	1	10	3	10 ÷ 3 = 3.333333333
TOTAL		79	11	90	37	90 ÷ 37 = 2.432432432

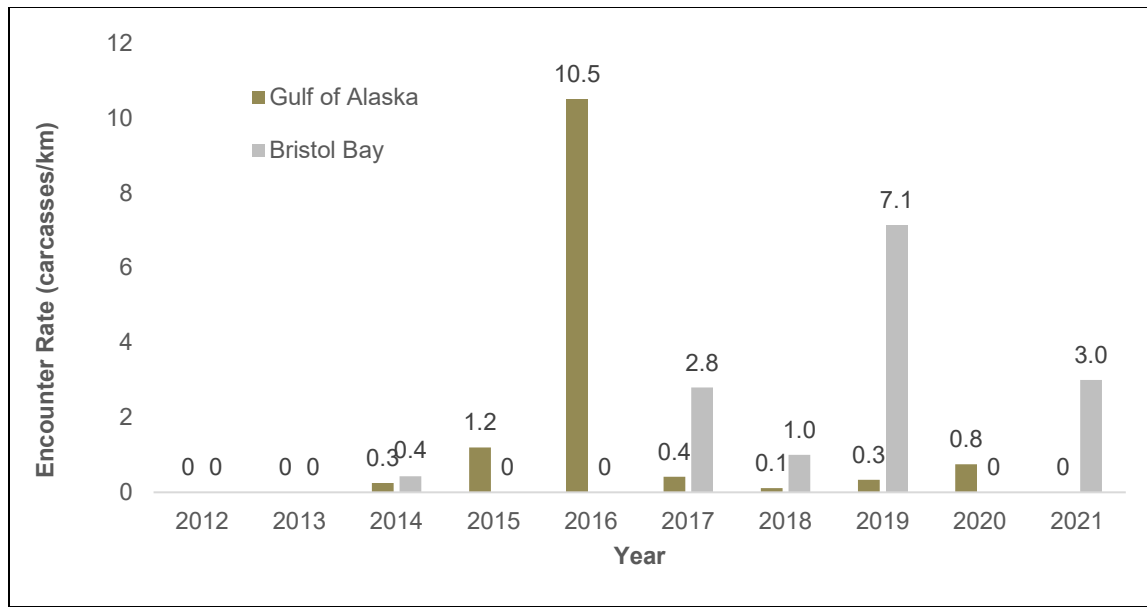


Figure 3. The average encounter rate (carcasses/km) for each survey effort year. The two regions we conducted surveys in (Gulf of Alaska and Bristol Bay) are represented with their own data bars.

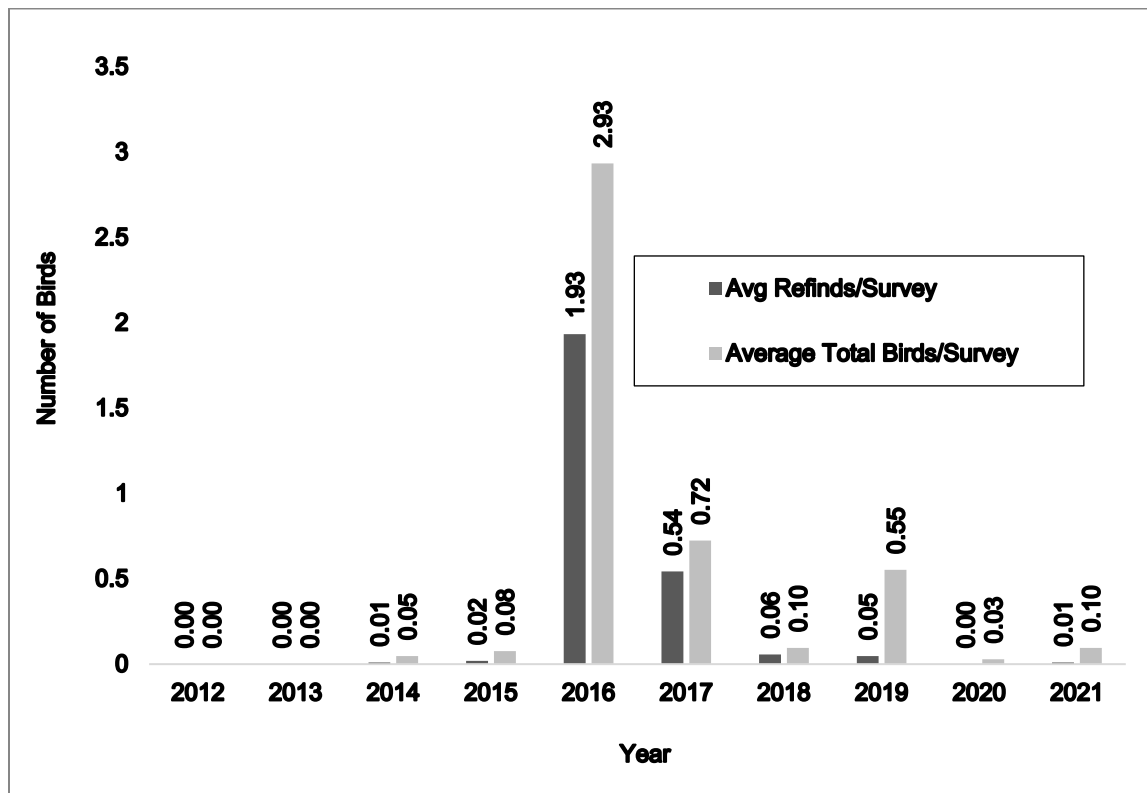


Figure 4. Average re-find events of seabird carcasses per survey in Katmai National Park & Preserve COASST survey sites (including Naknek beach) in relation to average total birds found per survey between the years 2012–2021.

Discussion

Our results indicate abnormal die-off events from 2016 and onward in the Gulf of Alaska and Bristol Bay regions. Carcass persistence was greatest at the Swikshak site as shown by the high rate of re-find events, perhaps due to the type of beach substrate along this shoreline (cobble substrate). Sites such as Swikshak and Naknek Beach, which contained the greatest overall number of carcasses documented throughout all years, present crucial data that highlight the severity of these events compared to normal years. This also underscores the importance of collecting baseline data on carcass encounters for comparison across years. Additionally, potential future events such as oil spills, abnormal weather patterns, and warm periods due to climate change may prompt more die-off events, and we can use this data to anticipate the effects these will have on seabird colonies along the Alaska Peninsula.

Die-off events occur periodically among seabird colonies (Lloyd et al. 1974; Scott et al. 1975; Bourne 1976; Piatt et al. 1991), but the magnitude of the 2015–16 common murre die off in the Gulf of Alaska was concerning. Abnormally large or frequent regionally specific die-off events harm the genetic diversity of the seabird species affected, which may impact the long-term viability of the population (Duffy 1992). Recent climate change models have predicted a high degree of change for oceanic warming and ice loss in globally significant core marine bird areas (Smith et al. 2019). While the possibility of a large oil spill event or severe storms present a real threat to seabird and other wildlife populations in this region, climate change presents far greater risks to species persistence, especially with warming oceanic temperatures decreasing the availability of forage fish species as a seabird food source. More research is needed to evaluate how changing ocean currents and temperatures affect ecosystem function in the north Pacific and what the implications for seabirds may be.

The National Park Service is charged with the preservation of its lands for current and future public use. Many people value the wildlife species that utilize these lands immeasurably, and the lands themselves are sought by humans and wildlife alike as a natural refuge in an increasingly developing world. The loss of any species diminishes our shared cultural heritage and biodiversity. KATM will continue to monitor seabird colonies and die-off events along its coast to better understand how climate change and other environmental factors affect seabird populations.

Literature Cited

- Bond, N.A., Cronin, M.F., Freeland, H., and N. Mantua. 2015. Causes and impacts of the 2014 warm anomaly in the NE Pacific. *Geophys. Res. Lett.*, 43:3414–3420.
- Bourne, W. 1976. The mass mortality of common murre guillemots in the Irish Sea in 1969. *Journal of Wildlife Management*, 40:789–792.
- Coastal Observation and Seabird Survey Team (COASST). 2016. A guide for COASST participants. Part four-module specific: beached birds. 3:4BB1–4BB59. Coastal Observation and Seabird Survey Team (COASST). 2022. <https://coasst.org/toolbox/beached-birds/>
- Duffy, D. 1992. Biodiversity and research on seabirds. *Colonial Waterbirds*, 15(1):155–158.
- Heymans, J., Guénette, S., and V. Christensen. 2007. Evaluating network analysis indicators of ecosystem status in the Gulf of Alaska. *Ecosystems*, 10(3):488–502.
- Kaler, R., Coletti, H., Schoen, S., and A. DeGange. 2016. Beached bird survey on the coast of Katmai National Park and Preserve, Alaska 14–19th March 2016. Unpublished Report.
- Katmai National Park & Preserve. 2022.
- Lloyd, C., Bogan, J., Bourne, W., Dawson, P. Parslow, J., and A. Stewart. 1974. Seabird mortality in the north Irish Sea and firth of Clyde early in 1974. *Marine Pollution Bulletin*, 5:136–140.
- Piatt, J., Carter, H., and D. Nettleship. 1991. The effects of oil pollution on marine bird populations. In J. White (Ed.), *The Effects of Oil on Wildlife: Research, Rehabilitation and General Concerns*, (pp. 125–141). Sheridan Press, Hanover, Pennsylvania.
- Piatt, J., Lensink, C., Butler, W., Kendziorek, M., and D. Nysewander. 1990. Immediate impact of the Exxon Valdez’ oil spill on marine birds. *The Auk*, 107(2):387–397.
- Piatt, J.F., Parrish, J.K., Renner, H.M., Schoen, S.K., Jones, T.T., Arimitsu, M.L., et al. 2020. Extreme mortality and reproductive failure of common murres resulting from the northeast Pacific marine heatwave of 2014–2016. *PLoS ONE*, 15(1):e0226087. <https://doi.org/10.1371/journal.pone.0226087>
- Piatt, J.F. and T.I. Van Pelt. 1997. Mass-mortality of Guillemots (*Uria aalge*) in the Gulf of Alaska in 1993. *Marine Pollution Bulletin*, 34(8): 656–662.
- Scott J., Wiens J., and R. Claeys. 1975. Organochlorine levels associated with a murre die-off in Oregon. *Journal of Wildlife Management*, 39:310–320.
- Smith, M.A., Sullender, B.K., Koeppen, W.C., Kuletz, K.J., Renner, H.M., and A.J. Poe. 2019. An assessment of climate change vulnerability for Important Bird Areas in the Bering Sea and Aleutian Arc. *PLoS ONE*, 14(4): e0214573. <https://doi.org/10.1371/journal.pone.0214573>

U.S. Fish & Wildlife Service (USFWS). 2019. 2019 Alaska Seabird Die-off [Fact sheet].
<https://www.nps.gov/subjects/aknatureandscience/upload/9Sep2019-Die-Off-USFWS-Factsheet-508C-revised-29Aug.pdf>

U.S. Fish & Wildlife Service (USFWS). 2021. 2021 Alaska Seabird Die-off Update [Fact sheet].
<https://coasst.org/wp-content/uploads/2020/02/6Nov2019-Die-Off-USFWS-Factsheet-508C.pdf>

Appendix A: Area Map

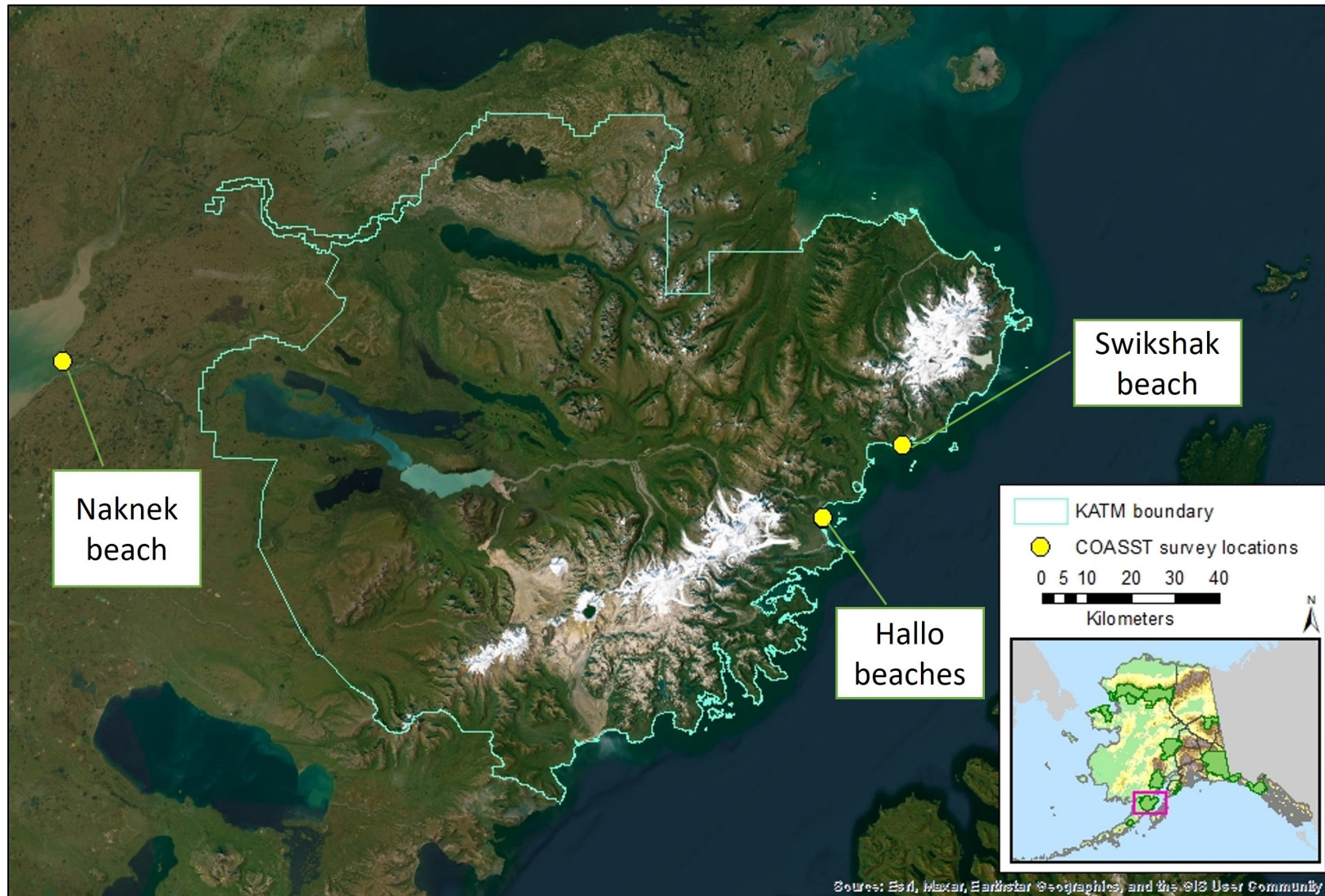


Figure A-1. Katmai National Park area map.

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