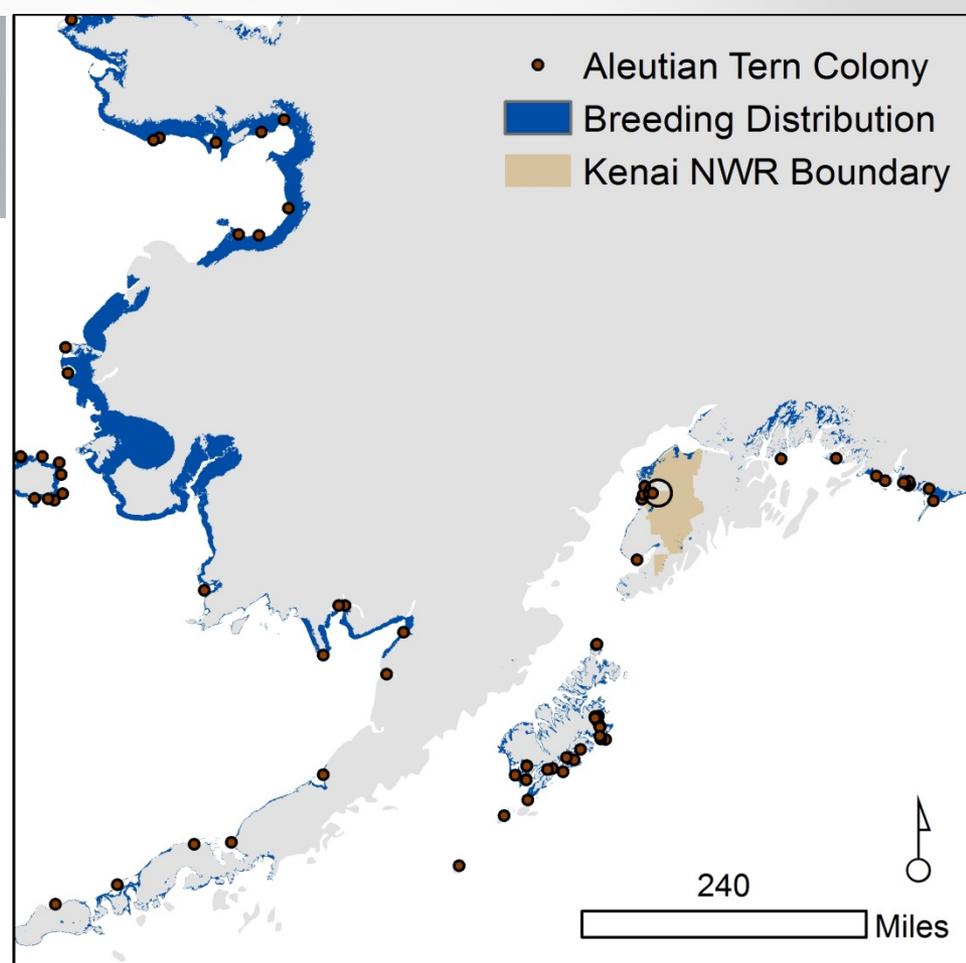




Kenai UAS Survey

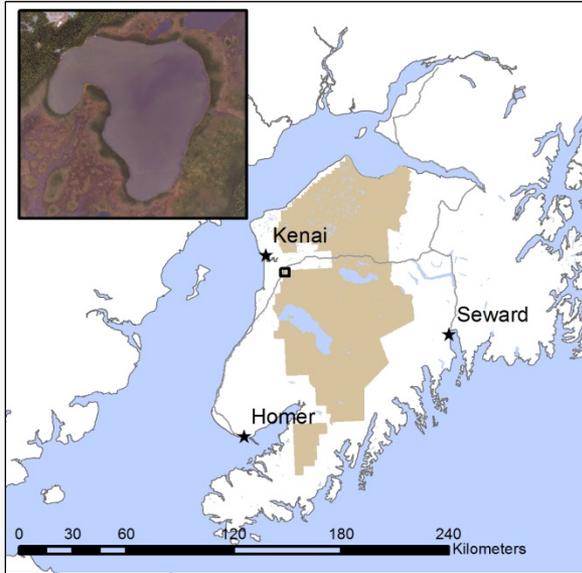


Dawn Magness, Todd Eskelin, & Mark Laker
Kenai National Wildlife Refuge
Soldotna, Alaska

Dawn_Magness@fws.gov

With guidance from Heather Renner and Martin Renner

Headquarters Lake Colony



Sparse ALTE / ARTE Colony

- **2003** Colony found when adult ALTE observed feeding a fledgling (~ 15-20 nests);
- **2013** ~ 35-50 nests
- **2017** 23 nests



Headquarters Lake Colony



2017 Objectives

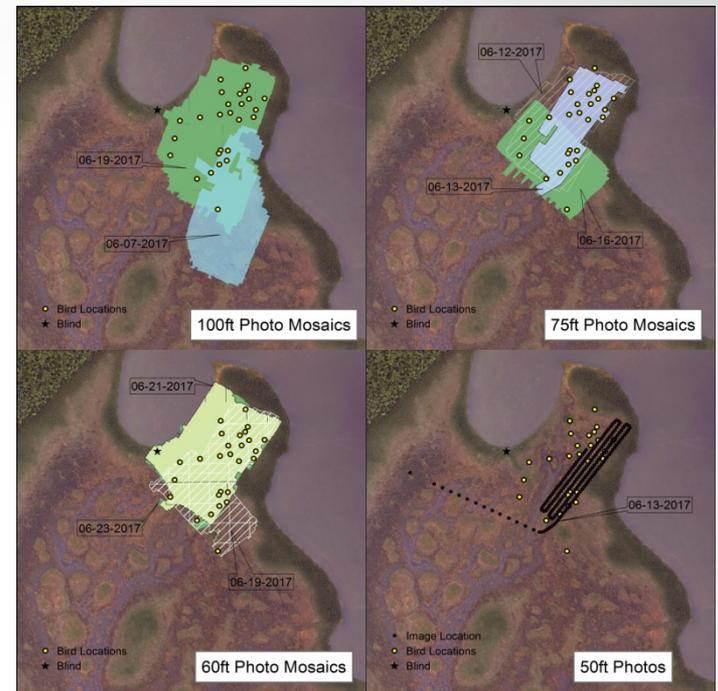
- to document nesting phenology
- to define UAS settings and flight altitude that is sufficient to distinguish Aleutian terns from Arctic terns;
- to document if UAS flight disturbs nesting terns; and
- to estimate colony size and compare to counts of terns in air.

Nesting Phenology

	2017 Headquarters Lake Aleutian Tern Colony	Expected From Literature
Arrival at Lake	5-11-2017 (Day 0)	
Occupying Colony Site	5-19-2017 (Day 8)	
Pair Formation / Copulation	5-25-2017 (Day 14)	
Nest Initiation	6-2-2017 (Day 22)	~ 14 days after arrival. Aleutian terns less synchronous than Arctic terns. Peak in mid-June
Fledging	~ 6-23-2017 (Day 43) Estimated. No observed fledglings	After 3-week incubation.

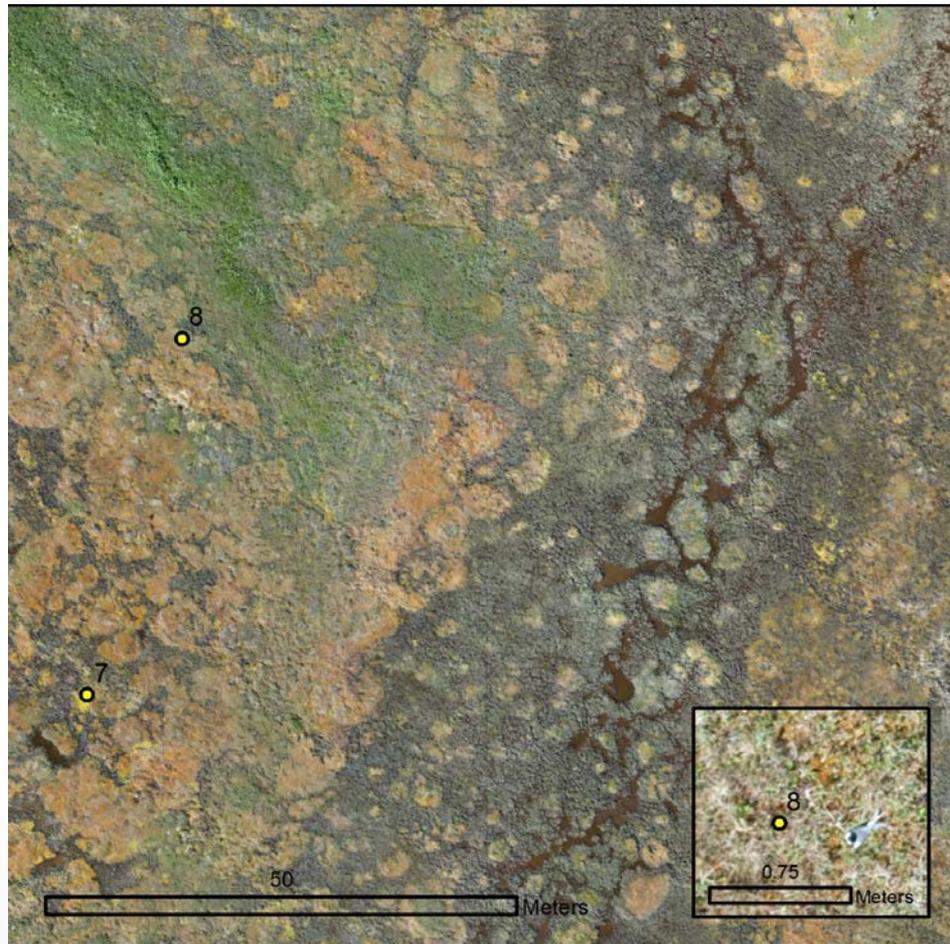
UAS

- 3DR Solo quadcopter
- 12 flight missions over 8 days



Date	Altitude	Total Time in Flight	Product
9 June 2017	61m (200ft)	15 minutes (11:16 – 11:30)	Observed reaction of terns to UAS (no photos)
9 June 2017	30m (100ft)	6 minutes (11:37 – 11:43)	4.2ha (10.acre) mosaic
12 June 2017	23m (75m)	13 minutes (11:30 – 11:43)	4.3ha (10.5 acre) mosaic
12 June 2017	23m (75m)	11 minutes (11:54 – 12:05)	None – Camera failure
13 June 2017	23m (75m)	11 minutes (12:01 – 12:12)	2.7ha (6.6 acre) mosaic
13 June 2017	15m (50ft)	14 minutes (12:27 – 12:41)	208 georeferenced images
16 June 2017	23m (75m)	13 minutes (12:03 – 12:15)	3.5ha (8.6 acre) mosaic
19 June 2017	30m (100ft)	12 minutes (10:58 – 11:10)	6.3ha (15.5 acres) mosaic
19 June 2017	18m (60ft)	26 minutes (11:16 – 11:30) and (11:38 – 11:50)	4.3ha (10.7 acre) mosaic; 856 georeferenced images
21 June 2017	30m (100ft)	13 minutes (11:46 – 11:59)	None – Camera failure
21 June 2017	18m (60ft)	~28 minutes (12:10 – 12:24) and (12:35 – 12:49)	4.8ha (11.8 acre) mosaic; 851 georeferenced images
23 June 2017	18m (60ft)	unknown	4.9ha (12.2 acre) mosaic; 1167 georeferenced images

Image Orthomosaic



UAS

Aleutian Tern

Arctic Tern

Unidentifiable

30m
(100ft)



23m
(75ft)



18m
(60ft)



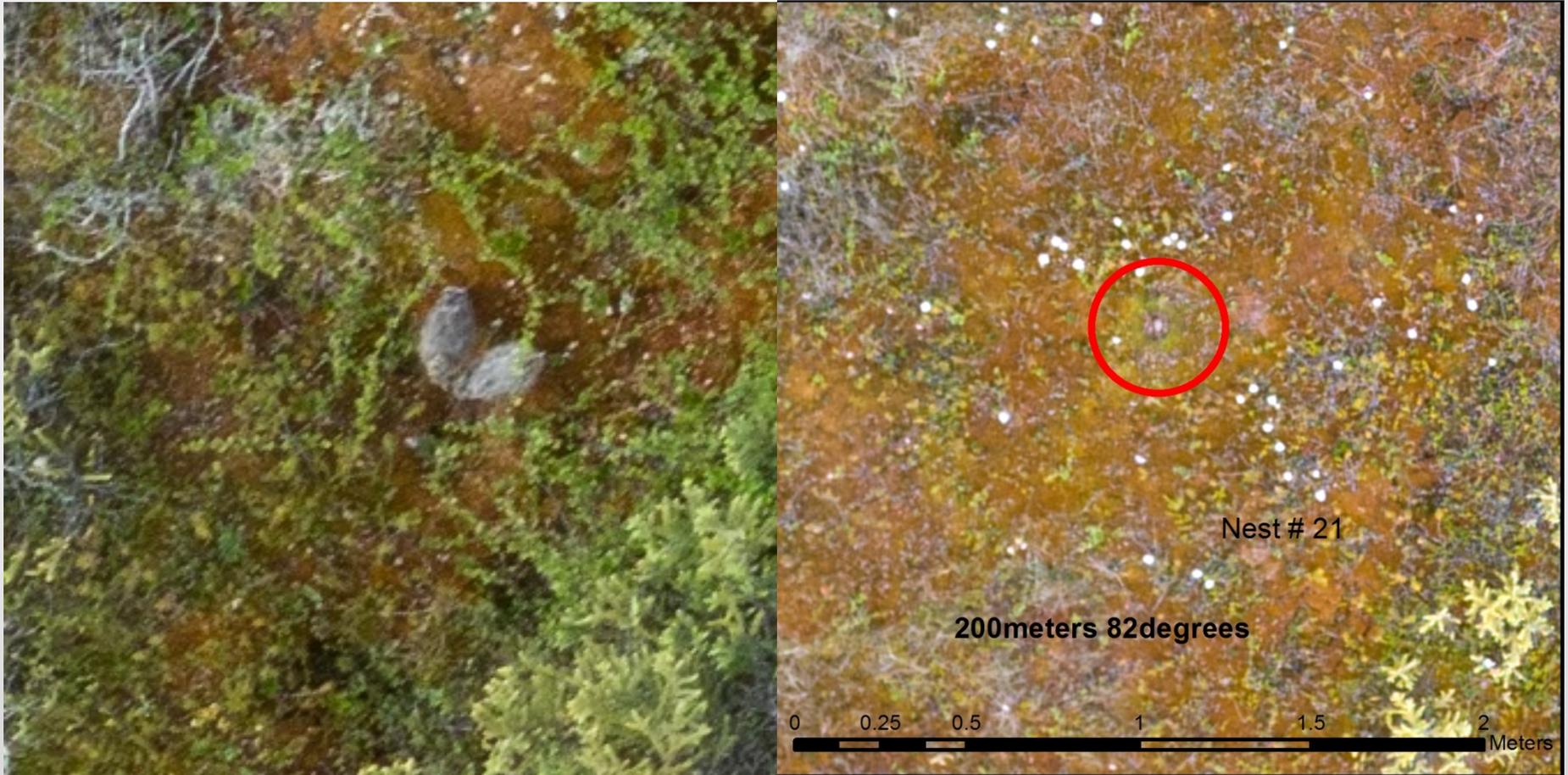
15m
(50ft)



- 23 nests found
 - 10ALTE, 7 ARTE, 4 Unidentified
- June 10-14 – best time to get terns on the nest
- Resolution ranged from 0.4-0.8 cm
- 100ft can see terns
- Species identification better at 15-18 with side angle shots

	Terns Photographed on Nest	Terns Off Nest	No Image Coverage
7-Jun	4	1	18
12-Jun	21	1	1
13-Jun	16	1	6
16-Jun	4	6 (4 with eggs/chicks)	13
19-Jun	8	15 (6 with eggs/chicks)	0
19-Jun	7	16 (7 with eggs/chicks)	0
21-Jun	5	14 (4 with eggs/chicks)	4
23-Jun	5	15 (3 with eggs/chicks)	3

Opportunity to Monitor Nests?

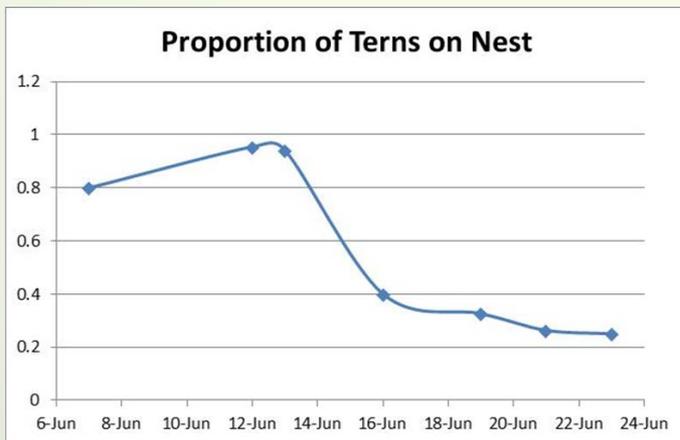




UAS Disturbance

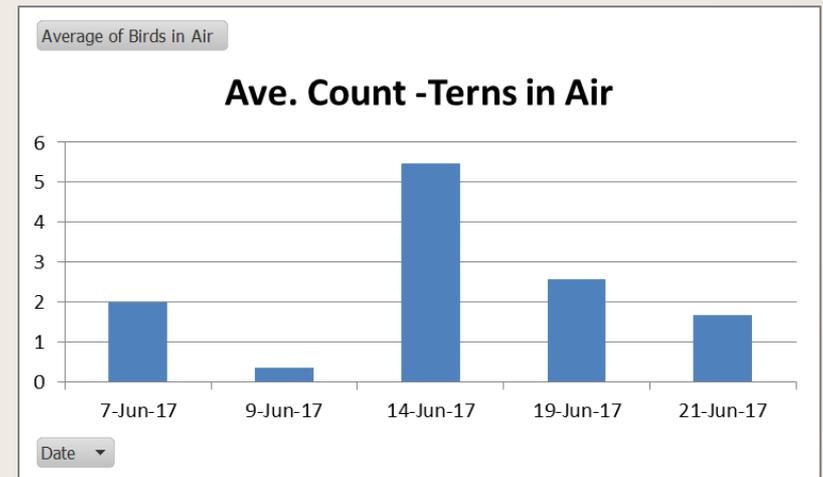
Observed 6 nests from blind
(3 ALTE, 3 ARTE)

UAS in Air	Sample Size	Average of All terns (n=6)	Average of ARTE (n=3)	Average of ALTE (n=3)
NO	63	0.68	0.62	0.74
YES	66	0.64	0.55	0.71
Total	129	0.66	0.59	0.72

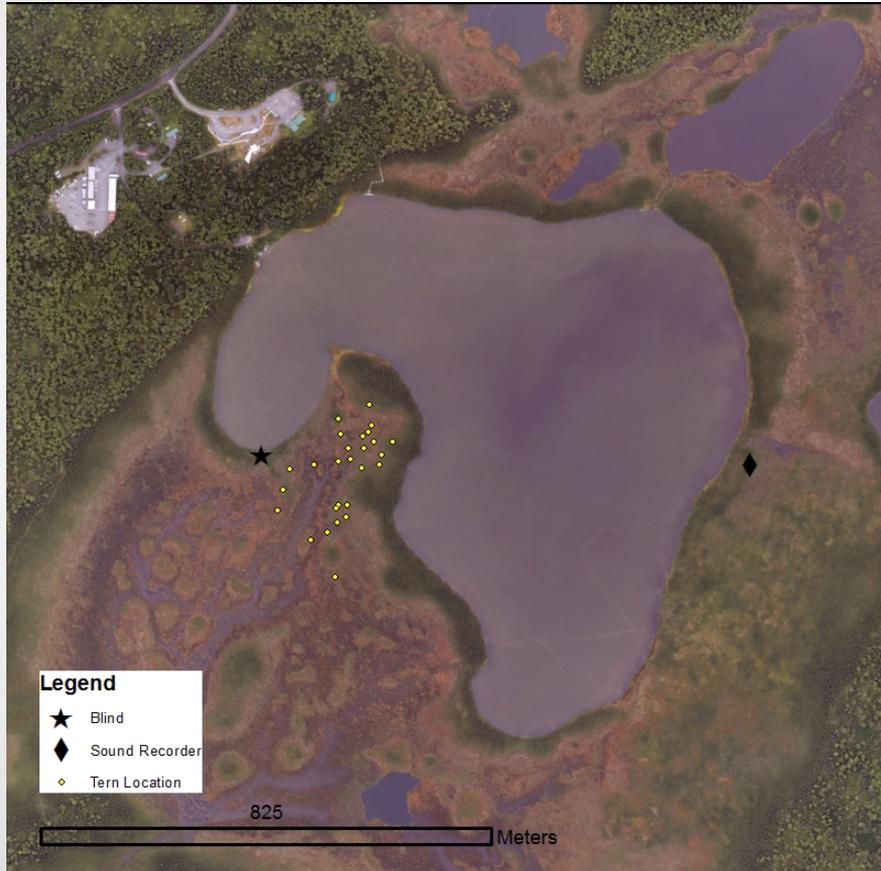


Counted terns in the air

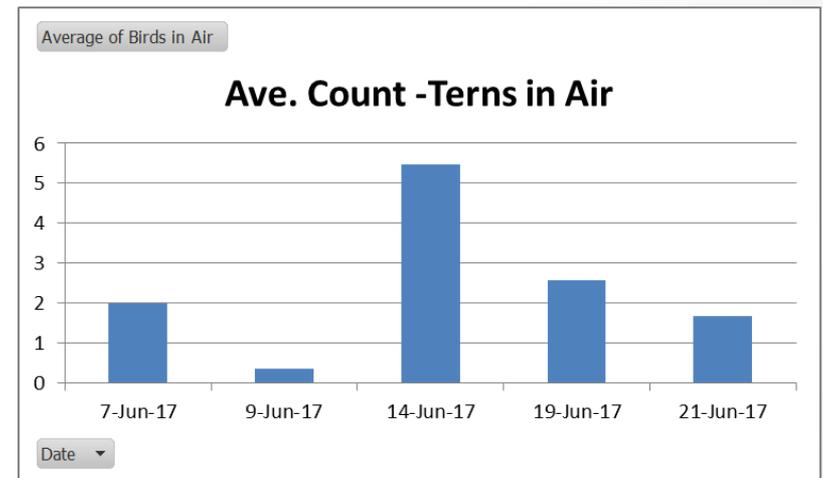
UAS in Air	Sample Size	Terns in Air (Average)	Std. Dev	Min	Max
NO	44	3.2	2.90	0	14
YES	41	1.2	1.37	0	5
Total	85	2.2	2.49	0	14



Birds in Air vs True Colony Size



- 23 nests
- Seasonal average of 2.2 birds in air
- Ranged from 0-14 during counts.



Next Year ?

