PROGRESS REPORT 2017-2018

Spatiotemporal Repeatability in Migration of an Arctic-breeding Shorebird, the Dunlin (*Calidris alpina*)

Benjamin Lagasse and Dr. Michael Wunder
University of Colorado Denver, Department of Integrative Biology

Proposal Abstract: Many arctic-breeding shorebirds are declining worldwide. Reasons for these declines are likely related to direct and indirect effects of human behavior including climate-induced changes in habitat conditions and food availability on breeding, migration and wintering grounds. However, the proximate link between a changing climate and habitat degradation on population-level declines is uncertain. It is also uncertain how arctic-breeding shorebirds might be adapting to these changes. Here, I propose to study plasticity in the migratory behavior of four subspecies of Dunlin (*Calidris alpina*) that breed in the Arctic and migrate along three major flyways of the world, including the Atlantic and Pacific flyways of North America and the East Asian-Australasian flyway of Asia. I will compare migration timing, routes, and stopover duration between individuals tracked from six breeding sites in 2010-2017, and within individuals from Utqiaġvik (formerly Barrow), Alaska tracked repeatedly from 2016-2020. This approach will allow me to determine the level of individual plasticity versus population-level microevolution present in the spatiotemporal migration ecologies of Dunlin from Utqiaġvik (tracks comprise 2010-2020, Table 1), and how it compares to the between-individual variation seen in Dunlin from other flyways undergoing different levels of environmental change. Such information will determine how migratory shorebirds might be adapting to the diverse and unsynchronized changes occurring throughout their annual cycle.

Executive Summary: May-August 2018 was the third consecutive field season for deploying light-level geolocators on Dunlin (*Calidris alpina*) breeding in Utqiaġvik (formerly Barrow), Alaska and the ninth consecutive season for work on this project. To date, 129 geolocators have been recovered across 125 individuals comprising 6 field sites, 4 subspecies, and 3 global flyways (Table 1). Field efforts for the 2018 breeding season in Utqiaġvik, AK included recapturing 5 individuals that provided repeat migration tracks from June 2016 to June 2018 and establishing a cohort of 40 Dunlin that are currently carrying geolocators. We will attempt to recapture and retag these 40 individuals in 2019 with the primary objective of acquiring repeat migration tracks to determine the level of individual plasticity versus population-level microevolution present in the spatiotemporal migration ecologies of Dunlin from Utqiaġvik (tracks comprise 2010-2020), and how it compares to the between-individual variation seen in Dunlin from other flyways undergoing different levels of environmental change (Table 1). This information will help determine how migratory shorebirds might be adapting to the diverse and unsynchronized changes occurring throughout their annual cycle.

Methods

Dunlin nests were found and adults captured on their nest while incubating. Preliminary analyses of recovered geolocators were done using the FLightR package in program *R*. FLightR is an advanced approach to geolocator analysis that employs a hidden Markov model to integrate knowledge about a species' behavior to refine daily location estimates. We then used FLightR to group daily location estimates into stopover sites when the bird was stationary for ≥2 days, and to estimate arrival and departure dates from each stopover site.

Recent Progress

Objective 1: Assess population-level variation in the migratory behavior of Dunlin (*Calidris alpina*).

Temporal migration itineraries for Dunlin recaptured in Utqiaġvik, AK in 2011 and 2017 showed minor differences between the two groups (Table 2-4). However, there was a shift toward earlier departure and arrival dates during spring migration in 2017 (Table 4). Analysis of geolocators from the five other field sites is ongoing.

Objective 2: Identify the role of phenotypic plasticity and population-level microevolution in the migratory behavior of Dunlin (*C. a. arcticola*) breeding in Utqiaġvik (formerly Barrow), Alaska and wintering on the East Asian-Australasian flyway.

Preliminary analysis of migration tracks for two individuals from June 2016 to June 2018 show within-individual variability in temporal migration itineraries, but rather consistent patterns of regional stopover use (Fig. 2, Table 5-7). For both individuals, spring departure date and corresponding patterns of spring stopover use showed the greatest difference between years (Fig. 2, Table 7).

2017-18 Expenditures

Funds received from the Blake-Nuttal Fund Grant ($3,600) were combined with funds from the American Ornithological Society's Alexander Whetmore Research Award ($2,400) to purchase 40 Migrate Technology Intigeo W65A9-SEA-NOT geolocators; these tags were deployed at Utqiaġvik, Alaska in June 2018. Funding for travel, food, salary, and field logistics were provided by the U.S. Fish and Wildlife Service.

Future Work

We are pleased to have recaptured five individuals with repeat tracks during the summer of 2018. However, it is still too few for a thorough analysis of the role of individual plasticity versus population-level microevolution present in the spatiotemporal migration ecologies of Dunlin from Utqiaġvik, AK. We have recovered these few repeat tracks primarily because of limited funds to purchase geolocators for retagging efforts in 2017. Funding from the Nuttall Ornithological Club and other grants allowed us to deploy 40 geolocators in Utqiaġvik in 2018. This established a cohort of Dunlin that are available for retagging in 2019, potentially increasing the number of individuals with repeat migration tracks from 5 to ≥15 in 2020. The ultimate success of this work is contingent on additional funding to purchase geolocators for deployment in 2019. We would like to thank the Nuttall Ornithological Club for supporting our past efforts and for considering our proposal to continue this work in the 2018-2019 performance period.

TABLE 1. Project timetable of past, current and proposed (italics) tagging efforts of four subspecies of Dunlin (*Calidris alpina*) captured at six Arctic-breeding sites in Alaska, Canada and Russia

Field site	Latitude, longitude	Subspecies, Flyway	Year	Tags deployed	Tags recovered
Churchill, Canada	58.7376, -93.8195	*hudsonia*, Atlantic	2010-2011	35	17
			2016-2017	30	10
Canning River, Alaska	70.1180, -145.8506	*arcticola*, EAAF	2010-2011	22	6
			2016-2017	13	3
Utqiaġvik, Alaska	71.3015, -156.7600	*arcticola*, EAAF	2010-2011	51	18
			2016-2017	46	18
			2017-2018	8	3
			2018-2019	40	N/A
			2019-2020	***24***	N/A
Yukon-Kuskokwim Delta, Alaska	61.1944, -165.1025	*pacifica*, Pacific	2010-2011	48	21
			2016-2017	15	6
Meinypil'gyno, Russia	62.5833, 176.9000	*sakhalina*, EAAF	2014-2015	5	3
			2016-2017	7	5
Belyaka Spit, Russia	67.0646, 174.4877	*sakhalina*, EAAF	2011-2012	10	5
			2013-2014	15	6
			2016-2017	14	8

N/A is used to denote situations where tags are to be recovered in 2019 or later.

Figure 1. Dunlin carrying a geolocator. Photo credit, Ben Lagasse.

Table 2. Fall migration of Dunlin (*Calidris alpina arcticola*) from Utqiaġvik, Alaska. Median (min – max) are reported.

Year	*n* ind.	Fall departure date	Total stopovers	Stopover days	Winter arrival date	Migration days	Distance traveled	Speed (Km/day)
2010-11	18	2 Sept. (13 Aug.–22 Sep.)	5 stops (3–7)	8 days (2–47)	5 Nov. (20 Oct.–8 Dec.)	70 days (47–89)	6,265 km (5,260–7,204)	110 (86–175)
2016-17	14	31 Aug. (18 Aug.–16 Oct.)	4 stops (1–7)	8 days (2–58)	4 Nov. (19 Oct.–3 Feb.)	61 days (12–169)	5,957 km (4,800–7,225)	113 (47–468)

Table 3. Itineraries of Alaska Dunlin (*Calidris alpina arcticola*) wintering in East Asia. Median (min – max) are reported.

Year	*n* ind.	Total winter sites	Stopover duration	Wintering days	Distance traveled	Speed (Km/day)
2010-11	15	2 stops 1–5	57 days 2–207	191 days 165–210	747 km 0–4,516	4 0–22
2016-17	14	1 stop 1–2	117 days 31–208	162 days 106–208	0 km 0–1,383	0 0–9

Table 4. Spring migration of Dunlin (*Calidris alpina arcticola*) to Utqiaġvik, Alaska. Median (min – max) are reported.

Year	*n* ind.	Departure date	Total stopovers	Stopover duration	Arrival date	Migration days	Distance traveled	Speed (Km/day)
2010-11	15	19 May 20 Apr.–25 May	2 stops 0–3	5 days 0–17	4 Jun 26 May–8 Jun	16 days 4–39	5,891 km 5,569–7,191	382 194–1,460
2016-17	14	8 May 11 Mar.–21 May	2 stops 0–9	6 days 0–28	30 May 21 May–4 Jun	23 days 4–79	5,957 km 4,800–6,740	289 97–1,391

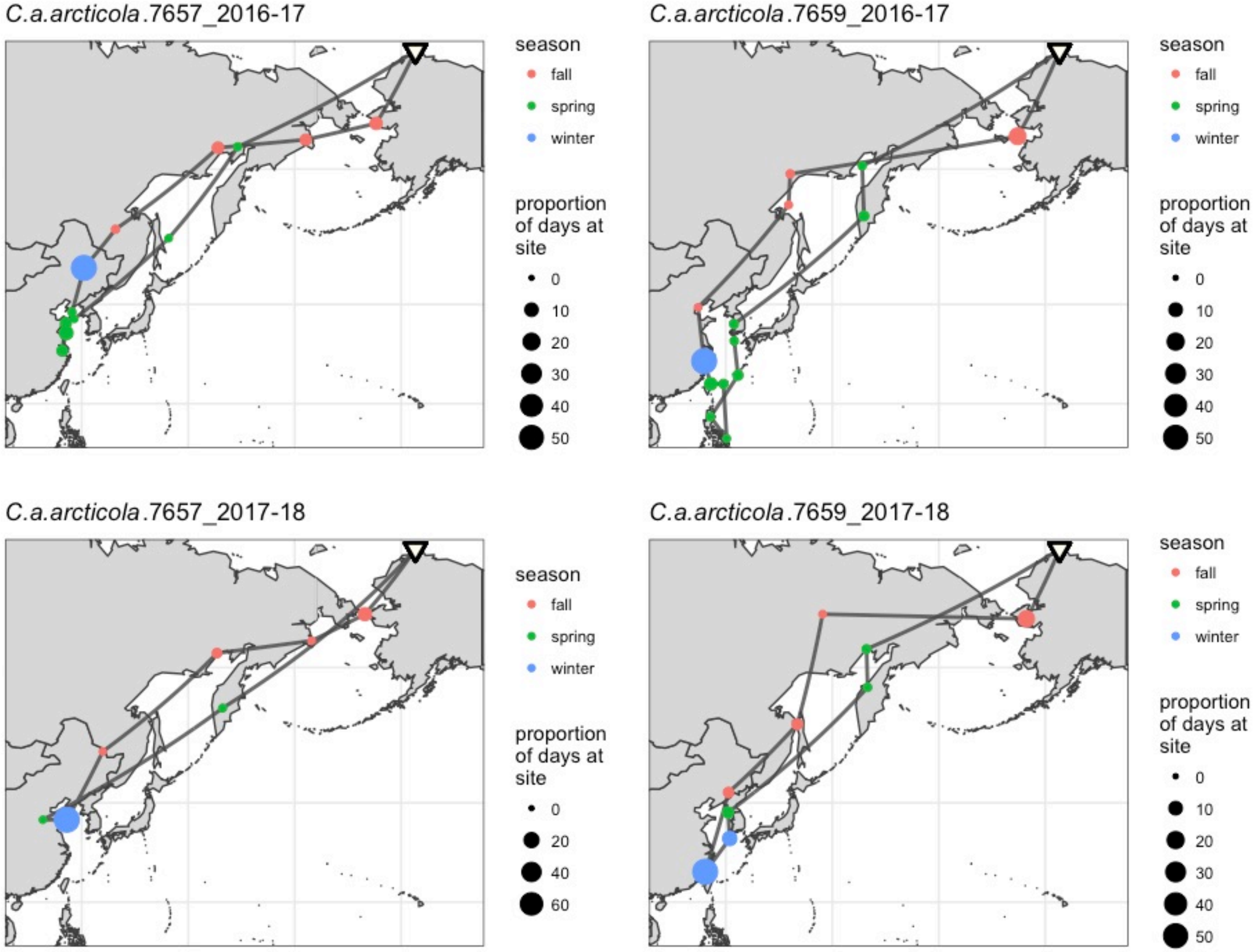

Figure 2. Repeat migration tracks for two individuals from Utqiaġvik, AK (June 2016 – 2018). Depicted are median location estimates for stopover areas where the bird was stationary for ≥2 days. Uncertainty surrounding each stopover estimate is not presented as analyses are ongoing.

Table 5. Repeat fall migrations of two Dunlin (*Calidris alpina arcticola*) from Utqiaġvik, AK. Median (min – max) are reported.

Year	Bird id	Fall departure date	Total stopovers	Stopover days	Winter arrival date	Migration days	Distance traveled	Speed (Km/day)
2016-17	7657	23 August	4 stops	14 (3-19)	19 October	57 days	5,353 km	94
2017-18	7657	17 August	4 stops	7 (2-34)	24 October	68 days	6,301 km	93
2016-17	7659	24 August	4 stops	3 (2-48)	30 October	67 days	7,716 km	115
2017-18	7659	1 September	4 stops	10 (2-43)	13 November	73 days	7,874 km	108

Rows with similar shading represent the same individual.

Table 6. Repeat itineraries of two Alaska Dunlin (*Calidris alpina arcticola*) wintering in East Asia. Median (min – max) are reported.

Year	Bird id	Total stopovers	Stopover days	Wintering days	Distance traveled	Speed (Km/day)
2016-17	7657	1 stop	143	143 days	0 km	0
2017-18	7657	1 stop	203	204 days	0 km	0
2016-17	7659	1 stop	139	138 days	0 km	0
2017-18	7659	2 stops	(30-139)	170 days	931 km	5

Table 7. Repeat spring migrations of two Dunlin (*Calidris alpina arcticola*) to Utqiaġvik, AK. Median (min-max) are reported.

Year	Bird id	Departure date	Total stopovers	Stopover days	Arrival date	Migration days	Distance traveled	Speed (Km/day)
2016-17	7657	11 March	7 stops	4 (2-27)	29 May	79 days	8,476 km	107
2017-18	7657	15 May	2 stops	3-4	31 May	16 days	7,069 km	442
2016-17	7659	17 March	9 stops	5 (2-19)	2 June	77 days	11,347 km	147
2017-18	7659	1 May	3 stops	5 (4-12)	5 June	35 days	6,432 km	184