

Wildlife Inventory Plan
Alaska Maritime National Wildlife Refuge
Protocol #10

Version 1.2

Parameter: Chick growth

Species: Black-legged and red-legged kittiwakes

PURPOSE

To examine patterns in growth rates of kittiwake chicks as a potential indicator of foraging conditions for adults. Chick growth rate in many seabird species has been associated with spatial and temporal variability in food availability (e.g., Suryan et al. 2002).

BREEDING BIOLOGY

Kittiwakes (*Rissa brevirostris* and *R. tridactyla*) are long-lived piscivorous seabirds that nest on cliffs in dense colonies. Red-legged and black-legged kittiwakes nest sympatrically on the cliffs at the Pribilofs Islands and Buldir Island in the Aleutians, and build nest structures on ledges with mud and vegetation. Red-legged kittiwakes generally lay a single egg each season, but black-legged kittiwakes often lay two and occasionally produce three eggs. Adults share incubation, brooding, and feeding duties. Chicks remain in the nest for about 40-45 days, although some may be capable of flights earlier (Byrd and Williams 1993, Hatch et al. 2009).

Kittiwakes are central place foragers during the breeding season and make daily foraging trips to provision chicks during the nestling period. They feed at or near the surface and are efficient flyers, making long trips and storing prey in their crop to deliver to their chicks (Hatch et al., 2009). Differences in food quantity and quality can influence rates of chick growth and development (e.g., Gill et al. 2002, Kitaysky et al. 2006, Romano et al. 2006), so chick growth may be a valuable parameter for monitoring fluctuations in the marine ecosystem.

PROCEDURES

Data collection.—Before chicks hatch, survey cliff areas used for chick growth studies (see island-specific details in attachments) to determine which nests can be reached safely with your ladder. Individually number potential nests with a paint pen and map their locations if this will help finding them again. If it is a failure year for kittiwakes and you cannot find 10 or more accessible chicks by peak hatch time, skip chick growth until the next season.

Once chicks hatch, attempt to measure each every 4-6 days during the linear growth period, from age 5 to 25 days or mass about 60 to 300g (see Figure 1; Coulson and Porter 1985, Jodice et al. 2008). Aim for at least three measurements per chick during this linear growth period. Because you may not know hatch dates and thus accurate chick ages, follow the below suggestions for when to start and stop measurements. If hatch date is unknown, wait a few days after you first see a chick before your first measurement to ensure chicks are at least 5 days old (but don't wait too long, or you won't get three measurements done during the linear growth period). Stop measuring the chick when (a) it exceeds about 300g, or (b) 20 days have passed since you started measurements (meaning it is about 25 days old, if you started at about 5 days). If you are uncertain, play it safe and measure the chick a couple extra times, as measurements outside the linear growth phase can always be truncated later.

During each measurement session, measure the following (see Figure 2):

- **Mass:** Weigh chicks (g) in bird bags using Pesola® spring scales. Be sure to weigh the empty bag after each chick weighing, because its weight can change due to moisture or chick

feces.

- **Wing chord:** Measure the right wing from the bend in the wing to longest tip (fleshy stub, pinfeather, or longest primary, depending on chick age; ignore any downy tufts stuck to the end of wings or feathers) using a 150 or 300 mm wing rule (depending on chick size). With the right wing resting naturally against the chick's body, slide the wing ruler under the wing and press the vertical stop gently against the wrist joint. Measure this distance to the nearest mm. Wing should be relaxed, not flattened.

If there is more than one chick in a nest (most likely for black-legged kittiwakes), measure only the alpha (larger) chick. Never measure chicks on wet or excessively windy days when leaving chicks unexposed in the nest for even short periods of time may be unsafe.

Nests are generally accessed by ladder from the beach below the cliffs (see Figure 3). Beach substrate is often uneven; one person should hold the ladder base while another climbs to the nests. When on the ladder, never stand on the top rung or reach so far to the side that you may be thrown off balance. Some people find it easiest to weigh and measure chicks directly at the nests, rather than descending the ladder with the chick in hand; others prefer to measure chicks down at the beach.

Working underneath cliffs can be dangerous work and safety precautions should be taken at all times. *All* crew members should wearing hard hats or climbing helmets at *all* times. Cliff habitat is somewhat unstable and rocks can fall at any time; even a very small rock can cause substantial damage if it falls from high enough (this is not a theoretical issue – in 2010, a rock severely injured a researcher working under the cliffs at St George). Always be alert for the sounds of rocks falling (often small pebbles may be a precursor to a larger rock fall). Take extra care after heavy rain, when cliffs may be more unstable than usual.

Many chicks will regurgitate upon capture and handling, so make sure to have diet collection supplies ready and available (see diet collection protocol) to collect any samples chicks may decide to donate.

Additional safety considerations for handling birds

Monitor the condition of birds you are handling at all times and look for signs of injury or stress (e.g., panting, droopy eyelids, appearing dazed, shivering). If a bird starts having problems, release it immediately. If you encounter a bird that appears diseased (e.g., avian pox), take care to prevent spreading to other birds at the colony. Destroy the bird bag used with that bird (do not reuse with other birds) and clean all measuring and banding instruments with 70% ethanol.

Data analysis.—Chick growth is summarized during the linear growth period only (see Figure 1; Hatch et al. 2009). In kittiwakes, this corresponds roughly to chick age 5-25 days, or 60-300g (Coulson and Porter 1985, Jodice et al. 2008); after this age, chick size approaches an asymptote. Because you may not know hatch dates and thus accurate chick ages, it is helpful to graph data for each chick and visually inspect graphs for any leveling off towards the end of measurements. Truncate any data points that appear to be beyond linear growth, either because measurements level off or because mass exceeds 300g. (Note - If you have only three measurements, it may be difficult to determine from the plot if the last measurement is outside the linear growth window; in these instances, mass is a particularly useful indicator.)

Once all data have been inspected and truncated to include only those measurements occurring during the linear growth period, calculate the growth rate for each chick by running a simple linear regression for each parameter (mass and wing chord). The slope of each regression line represents the growth rate. Present the average annual growth rate for each species as the mean slope (and standard deviation) of all chicks. Include only chicks that have been measured at least three times during the linear growth phase. If a chick dies after three measurements, it can be included in the dataset.

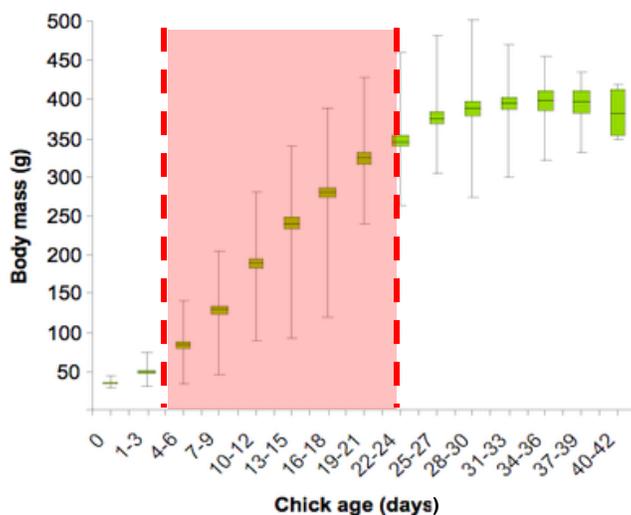


Figure 1. Change in body mass from hatching to fledging in black-legged kittiwake chicks at four locations in the Gulf of Alaska (Hatch et al. 2009). Linear growth period (chick age 5-25 days) is shown in red.

Literature Cited

- Byrd, G.V. and J.C. Williams. 1993. Red-legged kittiwake (*Rissa brevirostris*). No. 60 in *The Birds of North America* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.
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- Jodice, P.G.R., D.D. Roby, K.R. Turco, R.M. Suryan, D.B. Irons, J.F. Piatt, M.T. Shultz, D.G. Roseanu, and A.B. Kettle. 2008. Growth of black-legged kittiwake *Rissa tridactyla* chicks in relation to delivery rate, size, and energy density of meals. *Marine Ornithology* 36:107–114.
- Kitaysky, A.S., E.V. Kitaiskaia, J.F. Piatt, and J.C. Wingfield. 2006. A mechanistic link between chick diet and decline in seabirds? *Proceedings of the Royal Society of London B* 273: 445–450.
- Romano, M., J.F. Piatt, and D.D. Roby. 2006. Testing the junk-food hypothesis on marine birds: effects of prey type on growth and development. *Waterbirds* 29: 407–524.
- Suryan, R.M., D.B. Irons, M. Kaufman, J. Benson, P.G.R. Jodice, D.D. Roby, and E.D. Brown. 2002. Short term fluctuations in forage fish availability and the effect on prey selection and brood-rearing in the black-legged kittiwake (*Rissa tridactyla*). *Marine Ecology Progress Series* 236: 273–287.

Specific Requirements

Dates: Whenever chicks are 5-25 days old (60-300g), generally early July-early August.

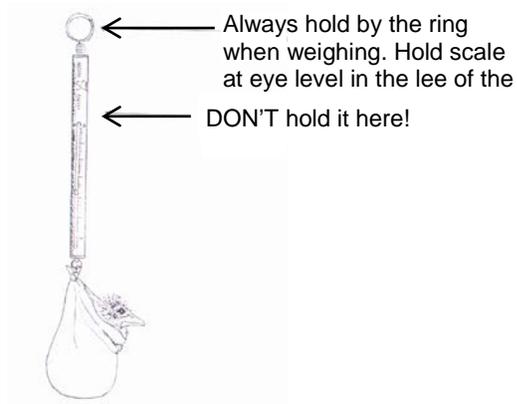
Optimum Sample Size: 30 chicks of each species (due to accessibility, usually only black-legged kittiwakes at St. Paul and red-legged kittiwakes at St. George).

Time of Day: Low tide to allow easier access to beaches.

Weather: Minimal precipitation and wind.

Equipment Needed: Paint pen (for marking nests on first visit), extension ladder, hardhats or climbing helmets, heavy gloves (for holding the ladder), Pesola[®] scales (100g, 300g, and 500g), wing rulers (150mm for small chicks, 300mm for large chicks), Rite-in-the-Rain[®] notebook, two pencils, at least two people (one to two to hold ladder/record data depending on location, one to climb and measure chicks), food collection supplies in case any birds regurgitate (see diet collection protocol).

Mass - Weigh chicks using a Pesola® scale. Weigh the bag and bird and then the bag separately at end. Check bag occasionally for dryness.



Wing chord - holding the wing next to the body and using a metal ruler with a stop, measure to the furthest feather tip possible. Always measure the right wing.

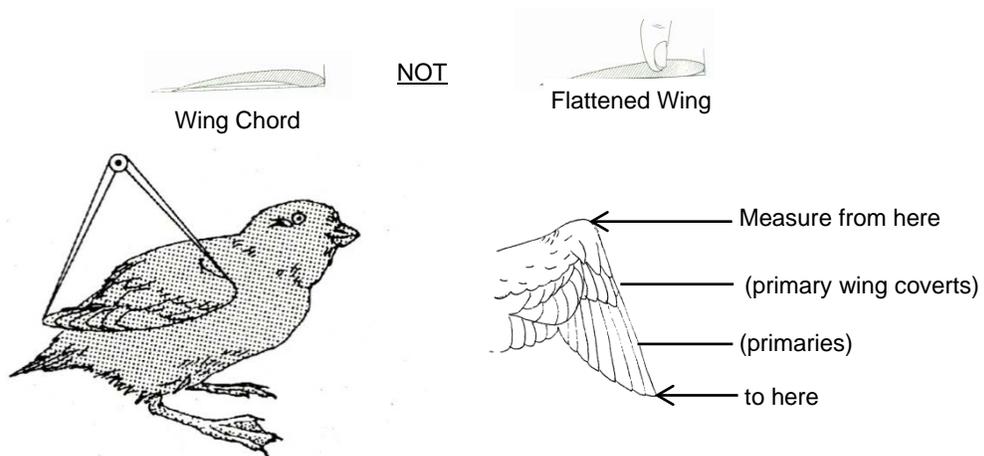


Figure 2. Diagram of kittiwake chick measurements taken on the Alaska Maritime National Wildlife Refuge.



Figure 3. Capture of kittiwake chicks for chick growth using extension ladder.

Attachment A. St. George Island specifics (includes Figures A1-5)

DESCRIPTION OF ST. GEORGE STUDY AREA

Red-legged kittiwake chick growth at St. George can be conducted at Village Cove (west side, directly underneath the store; Figures A1-2) and Rosy Finch Cove beaches (Figures A1, A3, A4). At Rosy Finch, you will need to transport the ladder in the truck and then maneuver it carefully down the rope access to the beach below (Figure A5). Because Rosy Finch is rarely accessed by villagers and the transportation of the ladder up and down the rope is so arduous, it is acceptable to leave the ladder at the site in between measurements. Try to hide the ladder below cliffs when not in use, making sure it is high enough to be safe from even the strongest storm surges, and remove it immediately after all chick growth measurements are complete. At Village, *never* leave the ladder out by the cliffs, as curious children have been known to use it to birdnap chicks.

Never do chick growth in areas used for productivity. In a population count year, do measurements after and not before the plot/area has been counted that day to avoid disturbing birds and biasing the count. If it is a failure year for kittiwakes and you cannot find 10 or more accessible chicks, skip chick growth until the next season.

Due to accessibility, chick growth is usually conducted only on red-legged kittiwakes at St. George. If enough black-legged kittiwake chicks are accessible, feel free to do measurements on them as well.

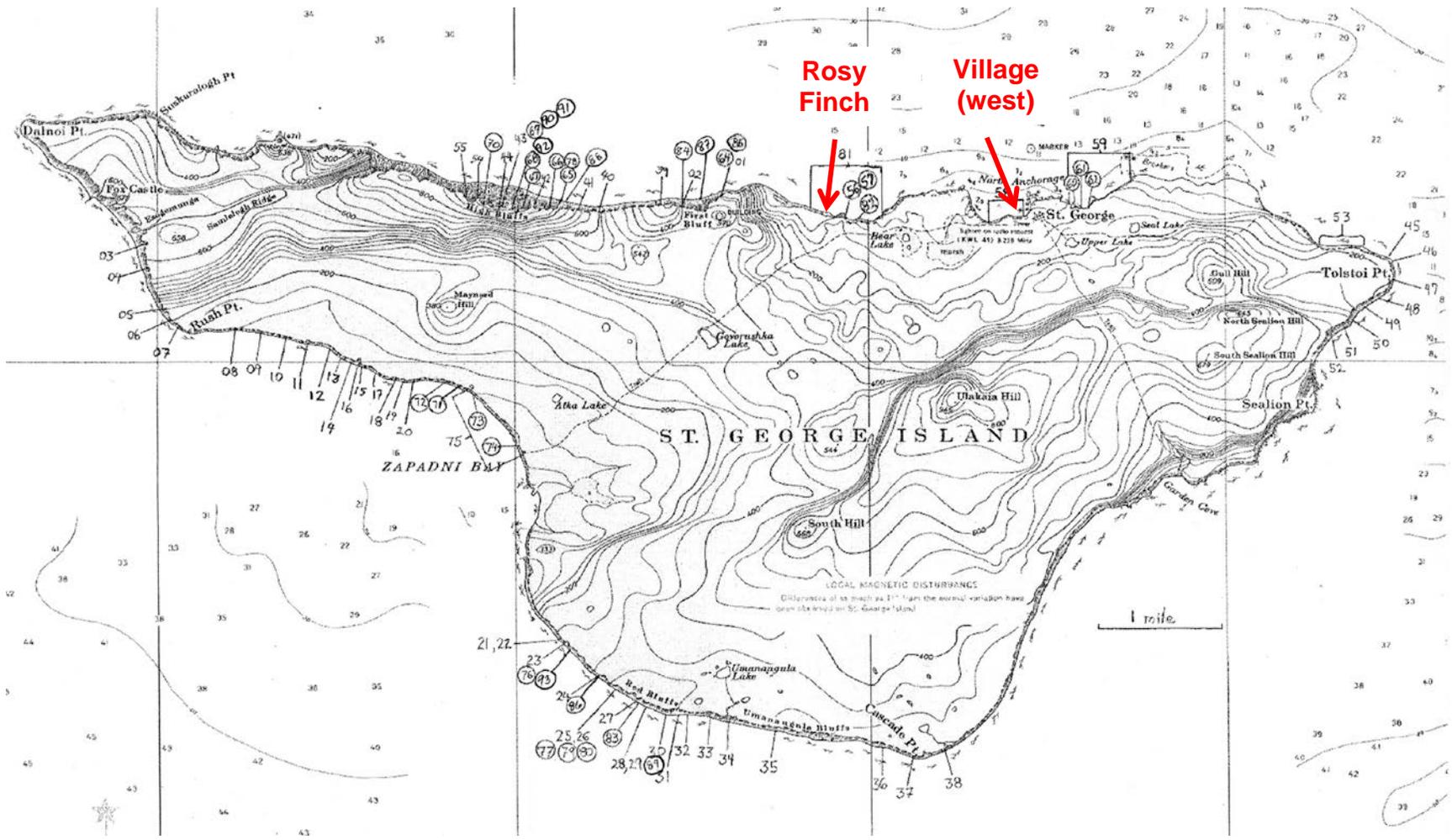


Figure A1. Map of potential locations for red-legged kittiwake chick growth at St. George Island.

Village (west)

also known as Plot 58A

View from east end access, looking west



Figure A2. Village Cove (west), St. George Island.

Rosy Finch

View looking east from rope



Figure A3. Rosy Finch Beach, St. George Island.



Figure A4. Rosy Finch Beach, St. George Island.

Access to Rosy Finch



Rosy Finch Rope Access
N 56.60180°
W 169.59808°



Figure A5. Access to Rosy Finch Beach, St. George Island.

Attachment B. St. Paul Island specifics (includes Figures B1-3).

DESCRIPTION OF ST. PAUL STUDY AREA

Black-legged kittiwake chick growth at St. Paul can be conducted at several locations along the low cliffs on the west side of the island: Tsamana North (also called Northwest Point), Tsamana and Southwest Point (Figures B1-3). All three locations are also black-legged kittiwake survival plots (see ledgenester survival protocol). Be sure to hide the ladder below cliffs when not in use; make sure it is high enough to be safe from even the strongest storm surges. Tsamana and Tsamana North are accessed from along the High Bluffs trail just north of Rush Hill, just a few minutes' walk north from productivity plot 44. When accessing the beach at Southwest Point, the ladder can be transported in the truck to Southwest Point and then put on ATV crosswise for the rest of the journey. Southwest Point is an area with more frequent rock falls, however, and should be used only when kittiwakes fail at the other sites.

Never do chick growth in areas used for productivity. In a population count year, do measurements after and not before the plot/area has been counted that day to avoid disturbing birds and biasing the count. If it is a failure year for kittiwakes and you cannot find 10 or more accessible chicks, skip chick growth until the next season.

Due to accessibility, chick growth is usually conducted only on black-legged kittiwakes at St. Paul. If enough red-legged kittiwake chicks are accessible, feel free to do measurements on them as well.



Figure B1. Map of potential locations for black-legged kittiwake chick growth at St. Paul Island.



Figure B2. Black-legged chick growth area at Tsamana/Tsamana North (Northwest Point), St. Paul Island.



Figure B3. Black-legged chick growth area at Southwest Point, St. Paul Island.

Protocol Revision History Log

Revision Date	Changes made	New version #
April 2015	Added stress and disease details per IACUC	1.2
April 2014	Changed font to Arial, added revision history log, replaced revision date with version # on first page, added protocol # to first page, changed number format of tables and figures in island attachments, changed page number format to include protocol #	1.1
May 2011	Protocol developed in standardized format from historic protocols, includes St. George and St. Paul attachments	1.0
