

A Photographic Guide to Aging and Sexing Snowy Owls from Hatching to Fledging:

Monitoring plumage and growth rates in Snowy Owl chicks

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Introduction

Accurately aging nestlings is important in studying reproduction and development in owls. Aging young can clarify hatching dates and help track developmental chronology and survival. Snowy Owls (*Bubo scandiacus*) provide a unique opportunity to document nestling development due to their accessible ground nests and resiliency to human presence, allowing researchers to answer many questions about their life history. This document provides a comprehensive guide to development and aging in Snowy Owls through age-specific behaviors and morphological changes, aiding researchers in the field and adding to the pictorial documentation of this declining species.

Methods

The Owl Research Institute (ORI) published mass growth rates and comprehensive descriptions of 8 stages of development in Snowy Owl nestlings in Utqiagvik, Alaska in 2016 using data and observations from 225 nestlings (see citations, page 16).

Here we supplemented these findings with observations and photographs from a nest in 2022 to create a photographic and descriptive guide to aging and sexing pre-fledging Snowy Owls. Stage 8 photographs taken by Dan Cox in previous years due to researcher departure from the field site in 2022. We delineate 8 developmental stages, from pipping in the egg to fledging between 44-55 days.

Table of Contents

Developmental Stages

Stage One: days 1 -4	Page 3
Stage Two: days 4 - 7	Page 4
Stage Three: days 8 - 14	Page 5
Stage Four: days 15 - 21	Page 6
Stage Five: days 22 - 28	Page 7
Stage Six: days 29 - 35	Page 8
Stage Seven: days 36 - 43	Page 9
Stage Eight: days 44 - 55	Page 10

Developmental Comparisons & Predicting the Sex of Chicks

Chick Development	Page 11 - 12
Primary Feathers	Page 13
Sexing Chicks	Page 14 - 15

Links, Citations, & Recommended Citation

Page 16



About the Owl Research Institute:

The Owl Research Institute (ORI) is dedicated to owl conservation through research and education. We are a non-profit, 501(c)(3), tax-exempt organization, established in 1988. Our headquarters are located in Charlo, Montana on the Flathead Indian Reservation. We conduct long-term research on owls, their prey species, and their relationship to the habitat in which they live. We use these data to provide information for maintaining viable populations. Additionally, we collaborate on strategic projects, educate the public about owls, and provide research data to land management agencies and conservation partners.

ORI is funded by individual and non-profit group donations, grants from foundations and corporations, and occasionally agency contracts. To learn more about our research or to contact us, please visit our website: www.OwlResearchInstitute.org.



STAGE ONE: days 1 - 4



Photo 1: July 17, 2022 - Chick 01 (pictured) was breaking out of the egg and likely finished hatching on July 18th. Chick 02 likely began to pip (break the egg open) the next day on July 19th, hatching the following day on July 20th.



Photo 2: July 20, 2022 - Chick 01 (top) and Chick 02 (bottom) had hatched, estimated at 3 and 1 days old, respectively. The bottom egg in the center can be seen with a small fracture as the chick inside begins to break out with its egg tooth.

Development & Behavior

Protoptile (first) down is all white, and pink skin is fully visible beneath.

The chicks have a calcified white egg tooth on the tip of their black bill (as shown in Chick 01, photo 2). This 'egg tooth' is not a real tooth, but a specialized structure used to break out of their shell.

Cere (fleshy covering at the base of the bill) is a light pink-gray color (see photo 5).

Eyes are fully sealed shut. Not shown in the photos are whitish talons and pink, featherless metatarsal pads and feet.

Nestling movement is very limited at this stage, but a soft twittering sound can sometimes be heard, likely the chicks begging for food or communicating with the female that they are hatched.



Photo 3: note the pink wing



Photo 4: note the body covered in protoptyle down



Photo 5: note the closed eyes, the light pink-gray cere, the egg tooth, and the pink skin

STAGE TWO days 4 - 7



Photo 6: July 23, 2022 - Chick 03 has finished hatching. Chick 04 (center egg) has begun to fracture its egg and begin the hatching process.



Photo 7: July 23, 2022 - The estimated ages of the nestlings are: Chick 01 (center) 6 days old, Chick 02 (right of center) 4 days old, Chick 03 (underneath Chick 01 on the left) 2 days old.

Development & Behavior

Gray mesoptile (second) down can be seen subcutaneously (underneath the skin), and eyes begin to slit open. Egg tooth is still present, and cere is still a light pink-gray. Metatarsal pads and feet remain featherless.

Nestlings are still helpless in the nest, but are able to move a bit. Vocalizations remain only a soft twittering.



Photo 8: the wing shows subcutaneous gray mesoptile down and a lack of flight feathers



Photo 9: from above, you can see mesoptile down subcutaneously and the lack of rectrices (tail feathers)



Photo 10: note the closed eyes and the light pink-gray cere

STAGE THREE: days 8 - 14



Photo 11: July 28, 2022 - Four chicks can be seen with one underneath the rest of the chicks on the left.

The two oldest Chicks, 01 and 02, are now in stage three, Chicks 03 and 04 are in stage two, and Chick 05 in stage one. Estimated ages: Chick 01 (top right) 11 days, Chick 02 (top left) 9 days, Chick 03 (bottom left) 7 days, Chick 04 (bottom right) 5 days, Chick 05 (unseen) 3 days, Chick 06 (egg) pipping front and center.



Photo 12: July 31, 2022 - All 6 chicks have finished hatching. Chicks 01, 02, 03, and 04 are now in stage three. Chick 05 is in stage 2 and Chick 06 is in stage 1.

Estimated ages: Chick 01 (left) 14 days, Chick 02 (right) 12 days, Chick 03 (center back) 10 days, Chick 04 (center top) 8 days, Chick 05 (center middle) 6 days, Chick 06 (center bottom) 3 days.

Development & Behavior

Gray mesoptile down begins to emerge from the skin and replaces the white protoptile down. Eyes can open now between 9-11 days, as seen in Chick 01, photo 11. At the end of this stage (around day 14), primary quill feathers on the wings begin to emerge (photo 13). Uropygial gland is large, void of feathers, and dark in color (photo 14). Legs and toes now have white feathers (photo 15).

Chicks are now more mobile in the nest and are able to hold their heads up. Chicks may begin to gular flutter to cool off, opening their mouths and vibrating their interior throat muscles and hyoid apparatus, comparable to panting. Chicks may start to bill snap when feeling threatened. Food begging is now a loud, long scream.



Photo 13: note primary quill feathers beginning to emerge



Photo 14: note lack of rectrices (tail feathers) around the uropygial gland



Photo 15: note feathers beginning to grow on legs and toes

STAGE FOUR: days 15 - 21



Photo 16: August 13, 2022 - Chick 06 at 16 days old after banding. July 20th.



Photo 17: August 8, 2022 - Chick 04 at 18 days old.

Development & Behavior

Chicks are now predominantly covered in gray mesoptile down.

The calcified egg tooth disappears (see photo 17), cere begins to darken in color, primary flight feathers erupt from their sheaths (photo 18), and tail feather quills are visible (photo 19). Legs and feet become more feathered (photo 20). The young experience a surge in body mass prior to nest departure.

The chicks are very mobile in and immediately around the nest. Pre-fledging departure from the nest begins.



Photo 18: note primary feathers beginning to erupt from their sheaths



Photo 19: note rectrices (tail feathers) beginning to emerge in sheaths



Photo 20: note feathered feet and legs

STAGE FIVE: days 22 - 28



Photo 21: August 8, 2022 - Chick 01 at 22 days old.



Photo 22: August 13, 2022 - Chick 01 at 27 days old.

Development & Behavior

Eyes are a deeper yellow; mesoptile down is a darker gray and juvenile plumage emerges, showing a white X around the eyes. Tail feather quills begin to erupt (photo 24) and primary feathers continue to emerge from sheaths. Feathers on the legs and feet grow longer.

Nestlings have departed their nest mounds on foot one at a time in the order they hatched. The chicks can now walk and run. They will generally stay within 1 km of their nest but are capable of moving farther, and will occasionally return to the nest area as they wander. The chicks will roost individually, near siblings, or occasionally in groups. The parents will usually stay in view of the young, however the females will roost closer to their young than males.



Photo 23: primary feathers further erupt from sheaths



Photo 24: rectrices begin to erupt from sheaths



Photo 25: feathers on feet and legs continue to grow longer, with feathers beginning to grow past toes

STAGE SIX: days 29 - 35



Photo 26: August 18, 2022 - Chick 01 at 32 days old



Photo 27: August 24, 2022 - Chick 03 at 34 days old (defensive posture)

Development & Behavior

All juvenile flight feathers are growing rapidly and synchronously, with primary wing feathers and coverts showing dark bars and spots. Cere is dark in color. Feathers around the eyes are beginning to look like a white mask.

Chicks now display a defensive posture with their wings outstretched when feeling threatened (photo 27).



Photo 28: primary feathers erupt further from sheaths



Photo 29: rectrices erupting from quills



Photo 30: feathers on feet and legs have grown long

STAGE SEVEN: days 36 - 43



Photo 31: August 27, 2022 - Chick 03 at 37 days old



Photo 32: August 27, 2022 - Chick 02 at 39 days old

Development & Behavior

At this stage, wing and tail feathers are well developed and there is a notable difference in plumage between males and females (described in 'Predicting the Sex of Chicks').

Gray down is still retained on the head, back, and breast. Juvenile plumage shows a developed white mask around the eyes.

Chicks will begin hopping and their first attempts at flying.



Photo 33: primary feathers are well developed



Photo 34: rectrices continue to develop



Photo 35: feet and legs are fully feathered

STAGE EIGHT: days 44 - 55



Photo 36: Stage 8 chick, precise age unknown



Photo 37: Stage 8 chick, precise age unknown

Development & Behavior

Flight feathers are now fully developed. Juvenile plumage replaces down, with the last down replaced on the head.

Most chicks are now flying with variable skills (see Photo 38) and are considered fledged. Chicks still depend on adults for food and will often roost in groups together or alone on mounds.

All Stage 8 photos taken in previous years by Dan Cox due to researcher departure from the field site in 2022



Photo 38: Chick begins to fly

Developmental Comparisons & Predicting the Sex of Chicks

The crew documented side-by-side head-on comparisons of chick development throughout stages 3-7, as well as primary wing development comparisons.

All 6 chicks were sexed using methods outlined in the publication titled 'Sexing Young Snowy Owls' ([Seidensticker et al. 2011](#)), described in the following pages.

Chick Development

Side-by-side comparisons of chick growth & plumage for stages 3 - 7

STAGE 3



11 Days Old
Chick 06



14 Days Old
Chick 05

STAGE 4



18 Days Old
Chick 03



20 Days Old
Chick 01



Chick Development (continued)

Side-by-side comparisons of chick growth & plumage for stages 3 - 7

STAGE 5



22 Days Old
Chick 01



27 Days Old
Chick 06

STAGE 6



30 Days Old
Chick 06



35 Days Old
Chick 01

STAGE 7



38 Days Old
Chick 01



39 Days Old
Chick 02

Primary Feathers

The following photos document primary flight feather growth, from quill emergence in stage 3 to fully grown flight feathers in stage 6.

STAGE 3: days 8- 14

Primary flight feather quills have begun to emerge in pin



STAGE 4: days 15-21

Primary flight feathers have begun to erupt from their sheaths



STAGE 5: days 22-28

Primary flight feathers have erupted from their sheaths



STAGE 6: days 29-35

Primary flight feathers are nearly fully grown in



Predicting the Sex of Chicks

The crew was able to predict the sex of the six chicks: Chicks 01, 02, and 03 were sexed as males, and Chicks 04, 05, and 06 were sexed as females.

Sex is predicted based on plumage. The primary flight feathers of females are more heavily marked and characterized by dark bars that touch the rachis (feather shaft near the center of the feather), whereas the primary flight feathers of males are characterized by dark spots that do not touch the rachis, and are less heavily marked and more white in appearance. Additionally, female Snowy Owl chicks have a sooty gray body plumage while males are light gray. These methods can be used to predict the sex of Snowy Owls through their first winter.

**Chicks on the left are males, and the chicks on the right are females.
Note the darker sooty body plumage of the females vs the males.**

Males



Females



Predicting the Sex of Chicks (continued)

The wing spreads on the left are males and the wing spreads on the right are females. Note the white, spotted primary feathers of the males and the dark, heavily barred primaries of the females.

Males



Females





Chloe Hernandez (left), Denver Holt (center), and Solai Le Fay (right) in Utqiagvik, Alaska in July 2022

Citations

Holt, D.W., K. Gray, M.T. Maples and M.A. Korte. 2016. [Mass growth rates and plumage development, and related behaviors of Snowy Owl \(*Bubo scandiacus*\) chicks.](#) *Journal of Raptor Research*. 50: (2).

Seidensticker, M.T., D.W. Holt, J. Deteinne, S. Talbot, and K. Gray. 2011. [Sexing Young Snowy Owls.](#) *Journal of Raptor Research* 45: 281-289.

Holt, D.W. 2022. [Why Are Snowy Owls White and Why Have They Evolved Distinct Sexual Color Dimorphism? A Review of Questions and Hypotheses.](#) *Journal of Raptor Research* 56(4), 440-454

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