HIGH ARCTIC INSTITUTE

By Kurt K. Burnham

Photos taken by Kurt and Jennifer Burnham, Jack Stephens, Bridger Konkel, Jeff Johnson, and Alex Paiement.

As the temperatures start to drop and the tundra begins to brown our 2019 field season in northwest Greenland draws to a close. It was a great season and we accomplished nearly everything we had hoped. We now start the long process of going through the ~300,000 photos taken by cameras at falcon nests, ~25,000 photos from cameras set on islands and at bird colonies, banding results, geolocator results, etc. As we have a chance to analyze these data we will provide periodic updates on our Facebook page for all of you to follow along: *www.facebook.com/HighArcticInstitute*

PHOTO SEQUENCE OF NESTING PEREGRINES IN THULE AREA.

TOP IMAGE: FEMALE SITTING EGGS WHILE THERE IS STILL SNOW AND ICE SURROUNDING HER.
MIDDLE IMAGE: YOUNG HAVE HATCHED AND ARE BEING FED BY FEMALE. NOTICE THE GOVERNMENT AND COLOR BANDS ON THE FEMALE IN THIS PHOTO. THIS ALLOWS US TO IDENTIFY INDIVIDUAL BIRDS FROM YEAR TO YEAR.
BOTTOM IMAGE: YOUNG ARE GETTING CLOSE TO BEING FULLY FEATHERED OUT AT EYRIE.

Thule Area, northwest Greenland (76.5° N, 68.7° W), 5 August 2019 – The still air is shattered by the piercing cack of a pair of peregrines as I and the rest of the High Arctic Institute field team approach the top of the cliff. Ropes are quickly tied off, climbing harnesses checked and double checked, and we begin our descent down the cliff face. A short distance from the nest and the falcon duet is joined by a chorus of four, 20 day old chicks. A few minutes later the cacophony begins to subside and in front of me sit the four peregrine chicks, bookended by two wide-eyed boys, my sons. This is their first time in a peregrine nest and it marks the third generation of Burnhams to study falcons in Greenland. It is hard to believe this is my 29th consecutive summer in Greenland, the changes my life has gone through in that span, the changes that Greenland has gone through during that time.

In the 1990s our field season in northwest Greenland would start in mid-July and the coastline would be full of pack ice. Now field seasons start in late June and the coastline is virtually ice-free. Over

LEFT: JEFF AND HANNAH BANDING THIS YEARS EYASS FALCONS. TOP: WHITE GYR FALCON FEEDING HER YOUNG. ABOVE: GYR CHICKS STARTING TO FEATHER.

this same period a warm day has gone from temperatures in the low 40s to high 60s, with a new record high temperature set almost every summer. Even our time camping in the field has changed. I used to enjoy a quiet and relaxing evening of cooking dinner with the field team. Those days are now gone, replaced by the incessant buzz of swarms of mosquitoes, a new addition to the far north

in the last 15 years. Most interestingly to me though are the changes the local bird populations have undergone during this period, specifically falcons.

Research on peregrine falcons in Greenland first started in 1972 in central-west Greenland (67.0° N, 50.7° W) under Bill Mattox, founder of the GPFS (Greenland Peregrine Falcon Survey). My late father, William Burnham, was part of the initial field teams (1972–1977) and spent months each summer backpacking around the area looking for peregrines. After the 1977 field season he began working for The Peregrine Fund, many years later becoming president. In 1991 he returned to Greenland, this time accompanied by me (age 16), and we spent two seasons as GPFS field team members.

By the summer of 1993 his interests had shifted farther north, and The Peregrine Fund created the High Arctic Institute to study populations of peregrines and gyrfalcons in the High Arctic of northwest Greenland. My annual participation, interest, and enthusiasm in Arctic falcon research continued unabated, including studying Greenland falcons in graduate school and becoming Arctic Projects Director for The Peregrine Fund. Shortly after my father's death in 2006, I founded the High Arctic Institute, with the support of The Peregrine Fund, as a not-for-profit corporation independent from The Peregrine Fund.

The High Arctic Institute's mission is to continue with the falcon research first started by Bill Mattox and my father in central-west and northwest (hereafter referred to as Thule) Greenland, respectively. Current research is primarily focused in the Thule area, with falcon surveys and research occurring on an annual basis. To better understand the diverse High Arctic ecosystem in the Thule area we have also expanded our research to include most all bird species occurring in the area, with an emphasis on species which are rare and occur at very low densities.

Juvenile Gyrfalcon at Thule Air Base.

We believe these species are the most likely to be impacted by current rapidly changing environmental conditions and will likely serve as environmental barometers going forward.

Our research is based out of Thule Air Base (a U.S. Air Force Base) in northwest Greenland, which provides us with weekly military flights to and from the High Arctic and a logistical hub to conduct our research from. Ice-free land and cliffs are predominantly found along the coast, with most inland areas covered by Greenland Ice Sheet. Weather can be severe, with winds in excess 100 mph and snow storms possible during any month of the year. The "breeding window" is one of the shortest on earth, with birds laying eggs shortly after arriving and young beginning to migrate south shortly after departing the nest.

What is the High Arctic and what makes it so unique? The High Arctic is a region at the most extreme northern edge of the Arctic (e.g. Spitsbergen, northernmost Russia, northern Canada, and northern Greenland). In these areas vegetation is extremely sparse, with no trees and most plants growing prostrate, rarely getting above a few inches in height. During the summer the sun is up 24-hours a day, simple doing lap after lap around the sky and never going below the horizon. The winter is the opposite, with up to three months of continuous darkness.

The Thule area is home to the healthiest populations of birds and mammals (land and sea) left in Greenland. An estimated 30–60 million Dovekies (a small seabird that only breeds in the High Arctic) nest in the area along with hundreds of thousands of thick-billed murres and black-legged kittiwakes. Common eiders are also abundant, with the largest colonies consisting of between 4000–5000 nests. Additionally, the area is the northern breeding limit for many bird species (e.g. Atlantic puffins, Arctic terns, great cormorants, etc.). These species commonly occur in very low numbers, with only a handful of pairs present in some years; including the most northern breeding population of peregrines in the world.

The idea of gyrfalcons and the High Arctic tend to go hand-in-hand. Most people think of a majestic white gyrfalcon perched high up on a cliff surveying the tundra as caribou feed below. When people think of peregrines though, they tend to have a different perception…perched on cliffs in the western U.S., on the bluffs of the Mississippi River, on bridges and buildings throughout the U.S. (and world).

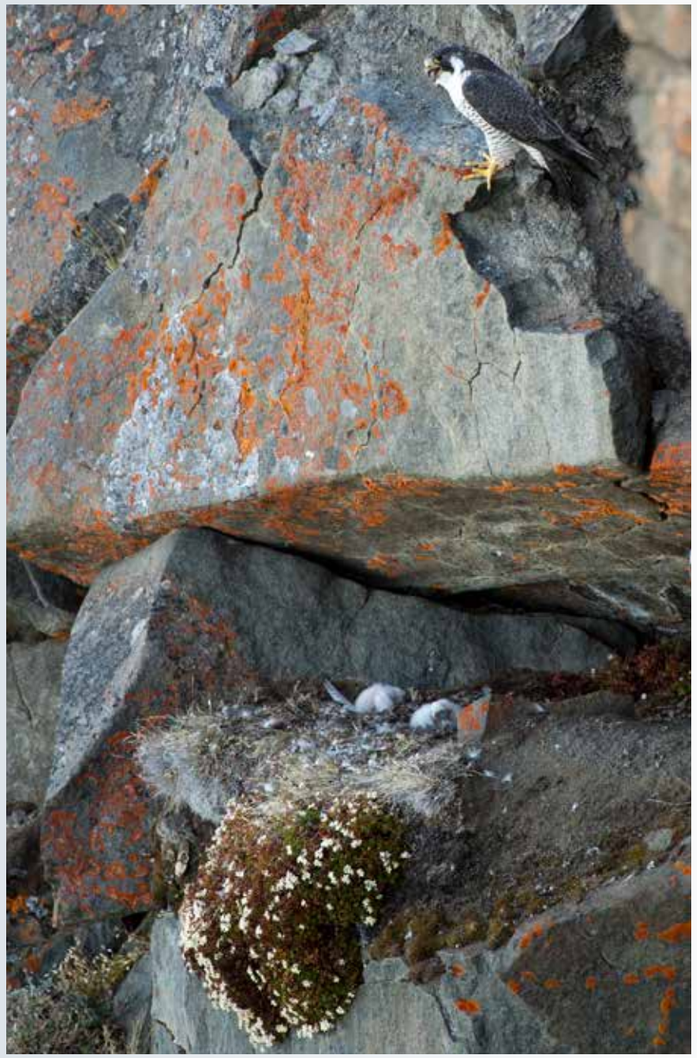
The High Arctic? 800 miles from the North Pole? Icebergs and glaciers? Not things most people associate with peregrines, which makes sense, because peregrines are not historically native to the region and are a relatively new species to the High Arctic.

In 1818 the first European explorers visited the Thule area, documenting and collecting the wildlife they observed, including gyrfalcons. In the years that followed numerous other expeditions have visited the area, again documenting and even collecting gyrfalcons. It was not until the early-to-mid 1900s though that were peregrines observed, and even then, they were only documented sporadically. Documentation of regularly nesting peregrines in Thule took place in the 1980s, although only at a single location, and even today peregrines are generally unknown to local Inuit, though gyrfalcons are readily identified.

Since 1993 the High Arctic Institute has conducted systematic surveys for peregrines and gyrfalcons throughout the Thule area, with our primary study area of approximately 500 miles of coastline established in 2001. Each summer we travel by boat to survey as much of the 500 miles coastline as possible, with storms, fog, and pack ice reducing the amount of coastline we can survey in some years. When occupied nests are found we collect as much information as possible, including data on nesting chronology, reproduction, and prey. In some years we have also captured and tagged the adults with satellite transmitters. More recently, we have begun installing nest cameras, providing us with much more detailed information than we have ever been able to collect in the past.

Since 2001 the number of occupied peregrine nests has dramatically increased in our study area from an average of four per season from 2001 to 2006 to an average of eleven from 2015 to 2018. The number of occupied gyrfalcon nests has remained relatively stable, with an average of approximately six nests occupied per season from 2001 to 2018. Of the 20 different cliffs where gyrfalcons have historically nested, five have recently been used by peregrines. In the few years when both falcon species have occupied the same cliff, peregrines have always appeared to be dominant over gyrfalcons, aggressively stooping and even striking the gyrfalcons whenever they take flight.

Peregrines eggs in Thule hatch on average in mid-July, and as late as the first half of August. In comparison, peregrine eggs in the Midwest U.S. hatch in early-to-mid May, well over two months earlier. Using data from satellite transmitters on peregrines we can see that in the first part of May peregrines nesting in Thule have barely begun their return migration and are usually still in Central or South America. Gyrfalcon eggs in Thule hatch even earlier than peregrines, usually in mid-June, with adult gyrfalcons arriving at nests as early as mid-April.



Weather conditions during incubation and young rearing can be severe in Thule. When gyrfalcons begin egg laying the temperatures are well below freezing, the ocean is frozen, and snow is abundant. It is not uncommon to visit a cliff early in the season and find an adult female incubating eggs while completely covered in snow with just her head visible. One advantage gyrfalcons have is that in Greenland they frequently nest under large overhangs, which provide protection from inclement weather. Our research has shown that these well-protected nests sites are of critical importance to the species. Carbon dating of built-up guano indicates that some nests have been used by gyrfalcons in the Thule area for at least 650 years. To the south, research from central-west Greenland shows even longer use, with some nests used by gyrfalcons for at least 2,500 years! Although nesting later in the summer, peregrines face severe conditions as well with snow always possible and winter setting in shortly after young have departed the nest.

Peregrines in Thule nest farther north than any other peregrine population and they have one of the longest migrations ever documented for falcons. Peregrines from Thule winter throughout South America, traveling up to 15,000 miles roundtrip while spending up to four months out of the year on migration. In contrast, gyrfalcons from Thule remain in the Arctic throughout the winter, moving south to winter in southern Greenland. Most surprising though is our research on gyrfalcons tagged with satellite transmitters in east Greenland. Some of these individuals displayed a previously unknown behavior in gyrfalcons; wintering on icebergs along the sea ice edge far from land. One individual spent 40 consecutive days over the ocean, likely resting on icebergs and feeding on seabirds and sea ducks which are commonly found along the ice edge in winter.

Our annual falcon surveys of the Thule area have also provided us with an opportunity to collect data on other breeding birds in the area and identify additional research priorities. For example, in 1999 while surveying for falcons we also collected data on the location of Arctic tern colonies and the number of individuals present. Ten years later, as we continued to pass by these same colonies each summer, we noticed many were either vacant or had very few individuals present. This led to the creation of an annual Arctic tern survey that started in 2009 which has shown a significant decline in pairs of Arctic terns and numbers of colonies.

Although the Thule area is extremely remote and suffers little from human disturbance, external factors have the potential to negatively affect local bird populations. Our research also includes work with pollutants, such as mercury, a toxic heavy metal which is produced by coal fired power plants at more southern latitudes and which bioaccumulates in the Arctic.

Results have shown that some top of the food chain avian predators in the Thule area have highly elevated levels of mercury in

their blood (peregrines have the highest levels), which has been shown to cause a wide range of reproductive and cognitive problems. Our research on migratory movements of Atlantic puffins, parasitic jaegers, and black-legged kittiwakes has helped to identify key wintering areas, some of which need protection from development.

Waterfowl populations are also rapidly changing throughout our research area. During a common eider duck survey in 2009 we counted over 20,000 nests, 5.4 times more than only 11 years prior. While impossible to know the exact reason for this increase, it is likely a combination of hunting restrictions put in place by the Greenland Home Rule Government and earlier sea ice breakup, which has been shown to have a positive effect on eider reproduction. During our research in Thule we have also noted species new to the area, including the first observation of a Ross's goose and the first confirmed breeding by lesser snow geese in Greenland. We also documented the first observation of northern pintails in north Greenland along with increasing numbers of both greater snow and Canada geese, in addition to more frequent observations of what

were once considered rare or uncommon species of waterfowl.

Why the changes? Why are we seeing species in Thule which used to only occur farther south? The likely answer is a rapidly changing climate. More specifically, the lengthening of the breeding window. As has been well documented across the Arctic, temperatures are rising and sea ice is breaking up earlier and re-forming later each year. As a result, spring is earlier, summer is longer, and fall is later.

How does this affect birds? Take peregrines for example. In the mid-to-late 1900s they sporadically occurred in the Thule area, likely successfully raising young in some years but more frequently failing due to cold temperatures and the severe climate. However, the climate moderates, adults can arrive and nest a little earlier, weather is warmer and more stable during the incubation and young rearing period, and in the fall young can spend a few extra weeks learning to hunt and survive on their own before migrating. Basically, the climate starts to much more closely resemble that of more southern areas in Greenland, where peregrines and many other species thrive. While peregrines increasing their range and moving north might seem good to those of us that love falcons, it's not good news for the planet.

As we finish banding the four peregrine chicks and readying ourselves to rappel the rest of the way down the cliff I look into the eyes of the peregrine chicks and my young sons. Their fates are intertwined. The changes in the Arctic we read about in the news are real and are occuring faster than can be imagined. I have seen them. I have lived them. There is no debate. There is no discussion. Look at the falcons if you need further proof. The gyrfalcon, endemic to the Arctic, now faces increasing competition from an invading peregrine population which is moving farther north each year. Some scientists now wonder if gyrfalcons will become a relic of the past by the end of this century, or perhaps exist only in the extreme far north of Greenland.

Although the futures of humans and falcons are intertwined, only we can change that future. Despite the Thule area being 800 miles from the North Pole its future depends on us and the decisions we make here and now in our lives. The future of gyrfalcons may well also depend on us, and I want to be sure that they are still around for a fourth generation of Burnhams to see.

To find out more about their research or donate to the High Arctic Institute visit www.higharctic.org. Follow them on Facebook at www.facebook.com/HighArcticInstitute to see more great photos, travel along with them during their 2020 summer field season in the Thule, or to donate and help support their research.