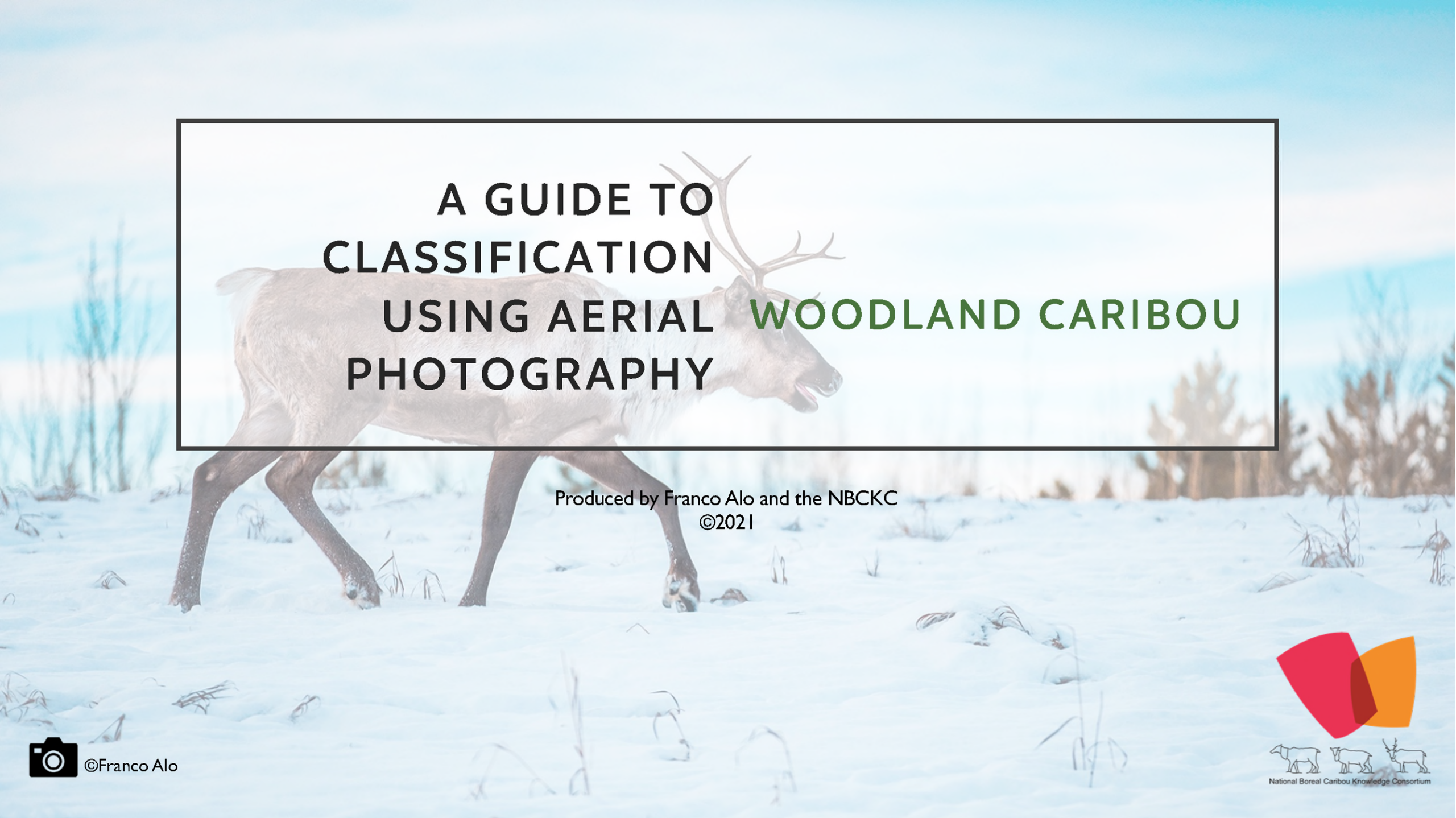


A caribou with antlers is walking through a snowy field. The caribou is brown with white underparts and is facing right. The background is a snowy landscape with some trees and a blue sky.

A GUIDE TO CLASSIFICATION USING AERIAL PHOTOGRAPHY

WOODLAND CARIBOU

Produced by Franco Alo and the NBCKC
©2021



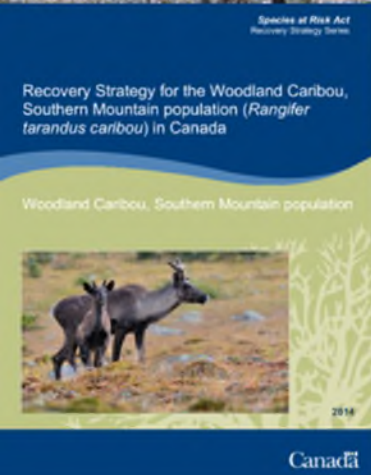
©Franco Alo



National Boreal Caribou Knowledge Consortium

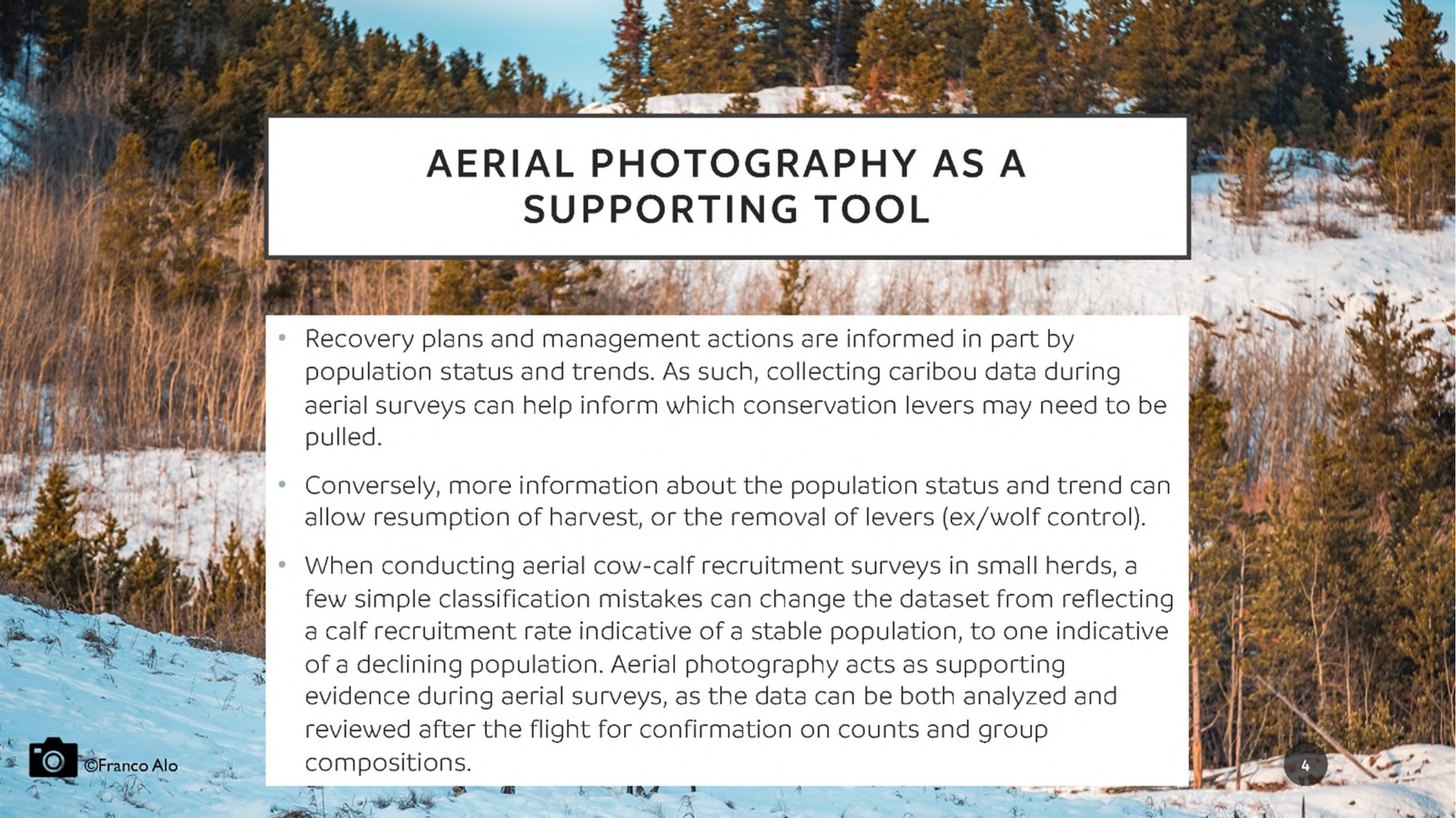
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IN CANADA, WOODLAND CARIBOU ARE A SPECIES AT RISK

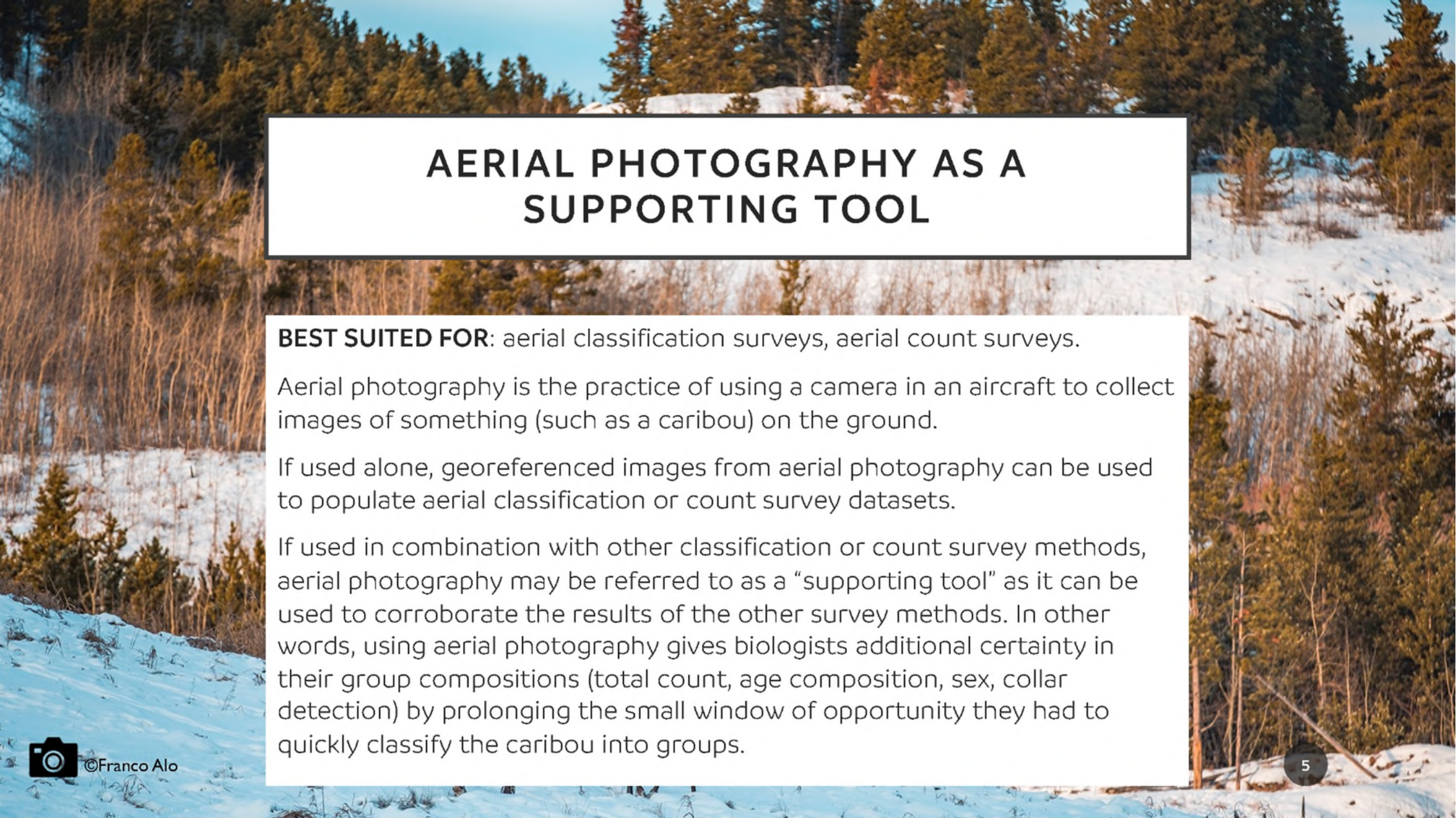
As the burdens of habitat loss, climate change, and other human mediated pressures continue to rise across Canada, more and more caribou herds require recovery planning. These plans benefit from a sound understanding of the specific factors leading to the herd's decline, and the obstacles to its recovery. Gathering reliable and accurate caribou monitoring information, that all parties can buy into, is thus a crucial step in the caribou recovery planning process.



AERIAL PHOTOGRAPHY AS A SUPPORTING TOOL

- Recovery plans and management actions are informed in part by population status and trends. As such, collecting caribou data during aerial surveys can help inform which conservation levers may need to be pulled.
- Conversely, more information about the population status and trend can allow resumption of harvest, or the removal of levers (ex/wolf control).
- When conducting aerial cow-calf recruitment surveys in small herds, a few simple classification mistakes can change the dataset from reflecting a calf recruitment rate indicative of a stable population, to one indicative of a declining population. Aerial photography acts as supporting evidence during aerial surveys, as the data can be both analyzed and reviewed after the flight for confirmation on counts and group compositions.





AERIAL PHOTOGRAPHY AS A SUPPORTING TOOL

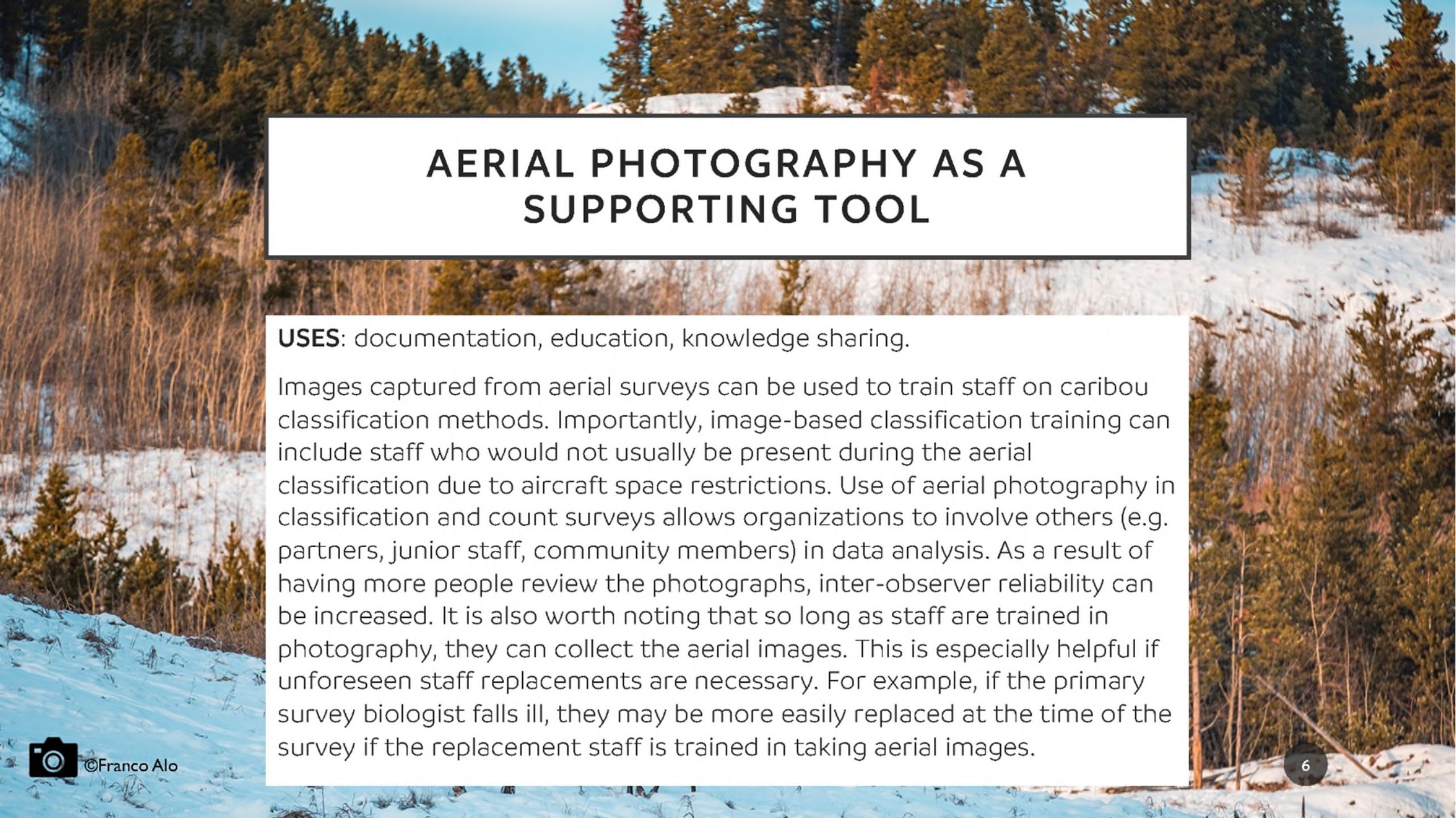
BEST SUITED FOR: aerial classification surveys, aerial count surveys.

Aerial photography is the practice of using a camera in an aircraft to collect images of something (such as a caribou) on the ground.

If used alone, georeferenced images from aerial photography can be used to populate aerial classification or count survey datasets.

If used in combination with other classification or count survey methods, aerial photography may be referred to as a “supporting tool” as it can be used to corroborate the results of the other survey methods. In other words, using aerial photography gives biologists additional certainty in their group compositions (total count, age composition, sex, collar detection) by prolonging the small window of opportunity they had to quickly classify the caribou into groups.



An aerial photograph of a snowy landscape. In the foreground, there's a snow-covered slope with some small evergreen trees. In the middle ground, there's a line of taller evergreen trees. In the background, a rocky outcrop is visible above the trees. The sky is clear and blue.

AERIAL PHOTOGRAPHY AS A SUPPORTING TOOL

USES: documentation, education, knowledge sharing.

Images captured from aerial surveys can be used to train staff on caribou classification methods. Importantly, image-based classification training can include staff who would not usually be present during the aerial classification due to aircraft space restrictions. Use of aerial photography in classification and count surveys allows organizations to involve others (e.g. partners, junior staff, community members) in data analysis. As a result of having more people review the photographs, inter-observer reliability can be increased. It is also worth noting that so long as staff are trained in photography, they can collect the aerial images. This is especially helpful if unforeseen staff replacements are necessary. For example, if the primary survey biologist falls ill, they may be more easily replaced at the time of the survey if the replacement staff is trained in taking aerial images.



USING PHOTOGRAPHS TO CLASSIFY CARIBOU

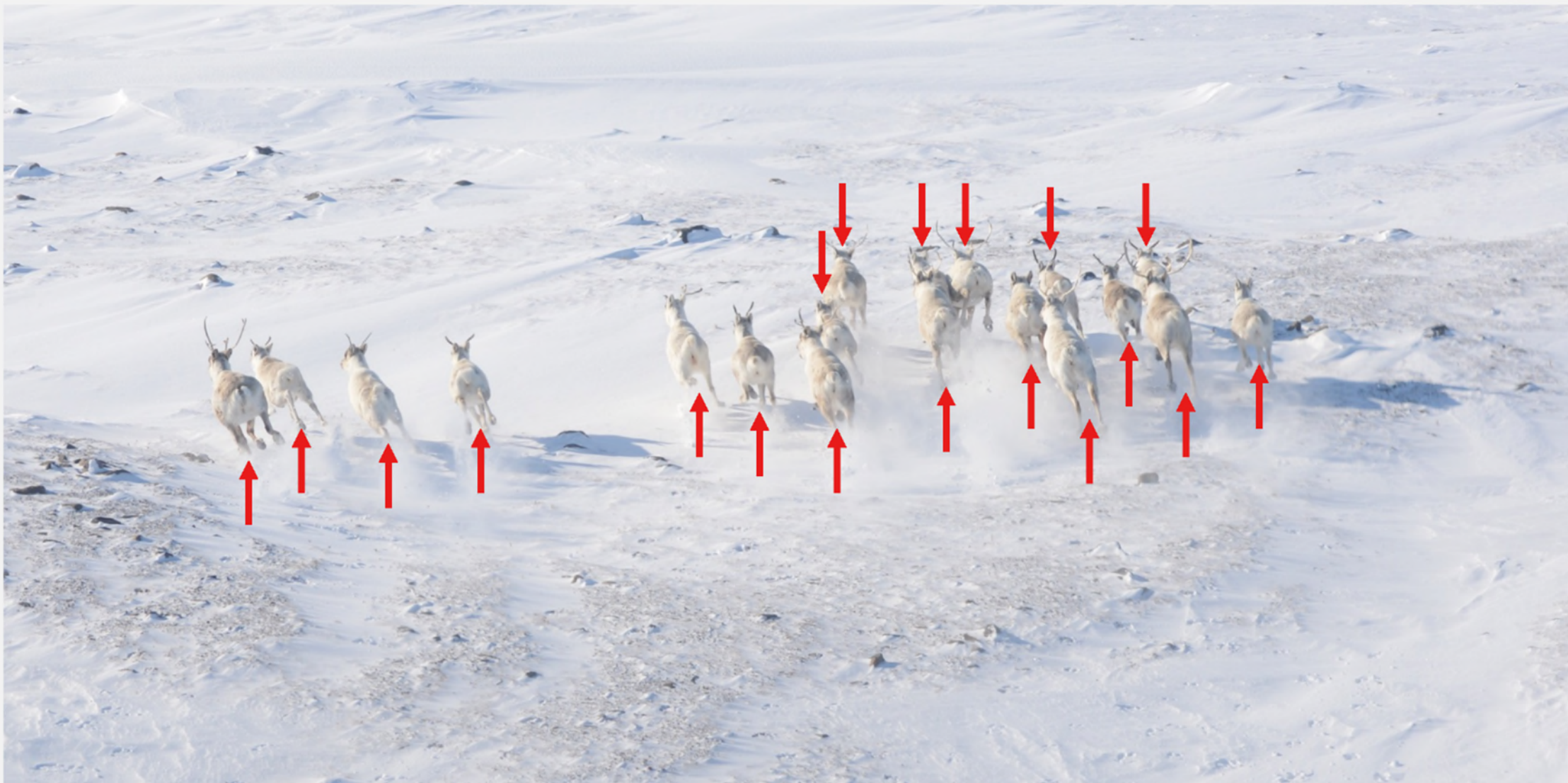
- Torngat Mountains, March 2017
- George River, October 2010
- Mealy Mountains, March 2010
- Liard, October 2020



Aerial photography can be used to: **confirm total group counts; useful for small and large groups**



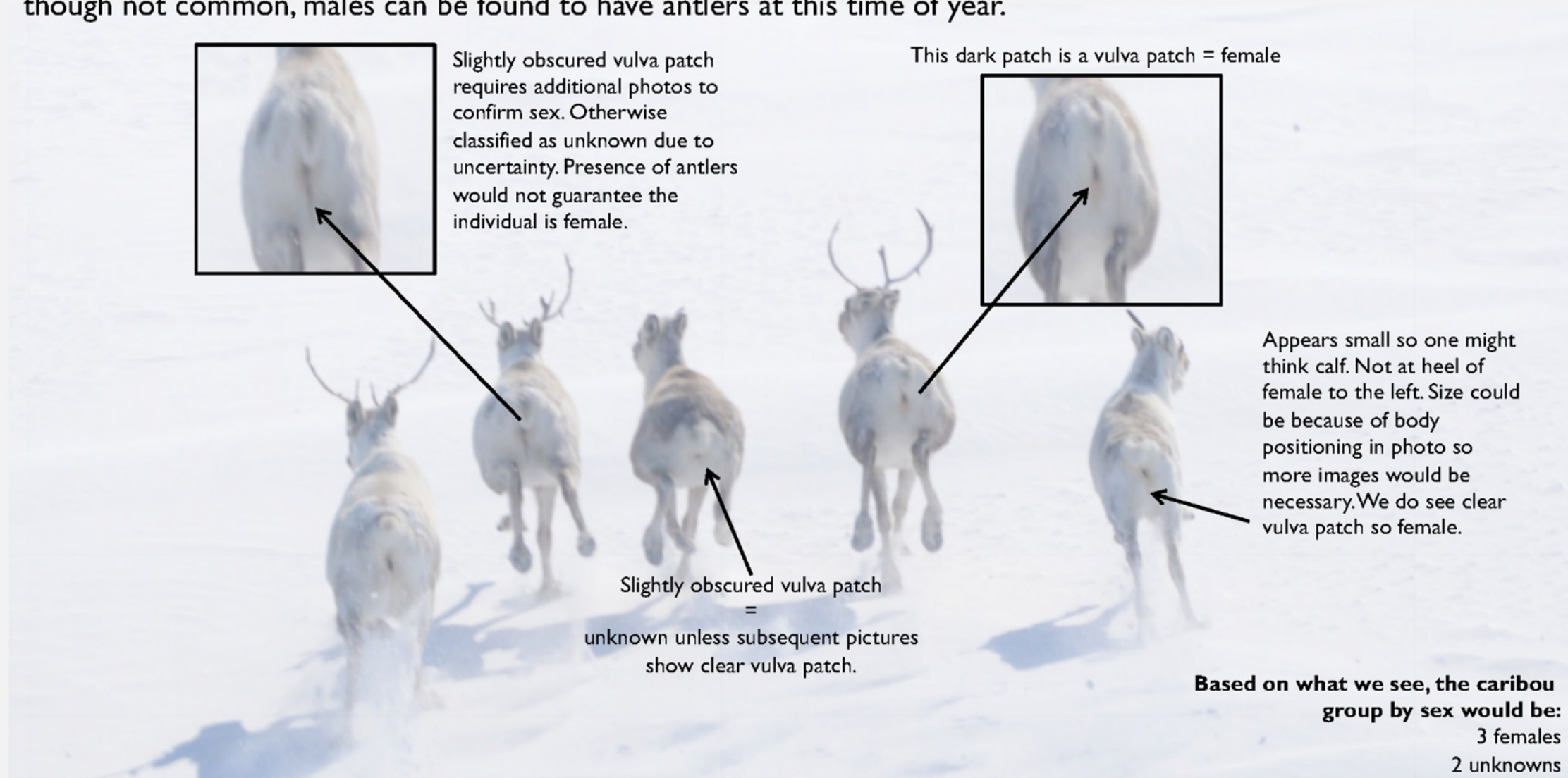
Total: **19 individuals**



Aerial photography can be used to: **classify caribou by sex**



The identification of a vulva patch denotes a female. Presence of antlers does not guarantee the sex of the individual, as though not common, males can be found to have antlers at this time of year.



Aerial photography can be used to: **identify how many individuals have antlers**

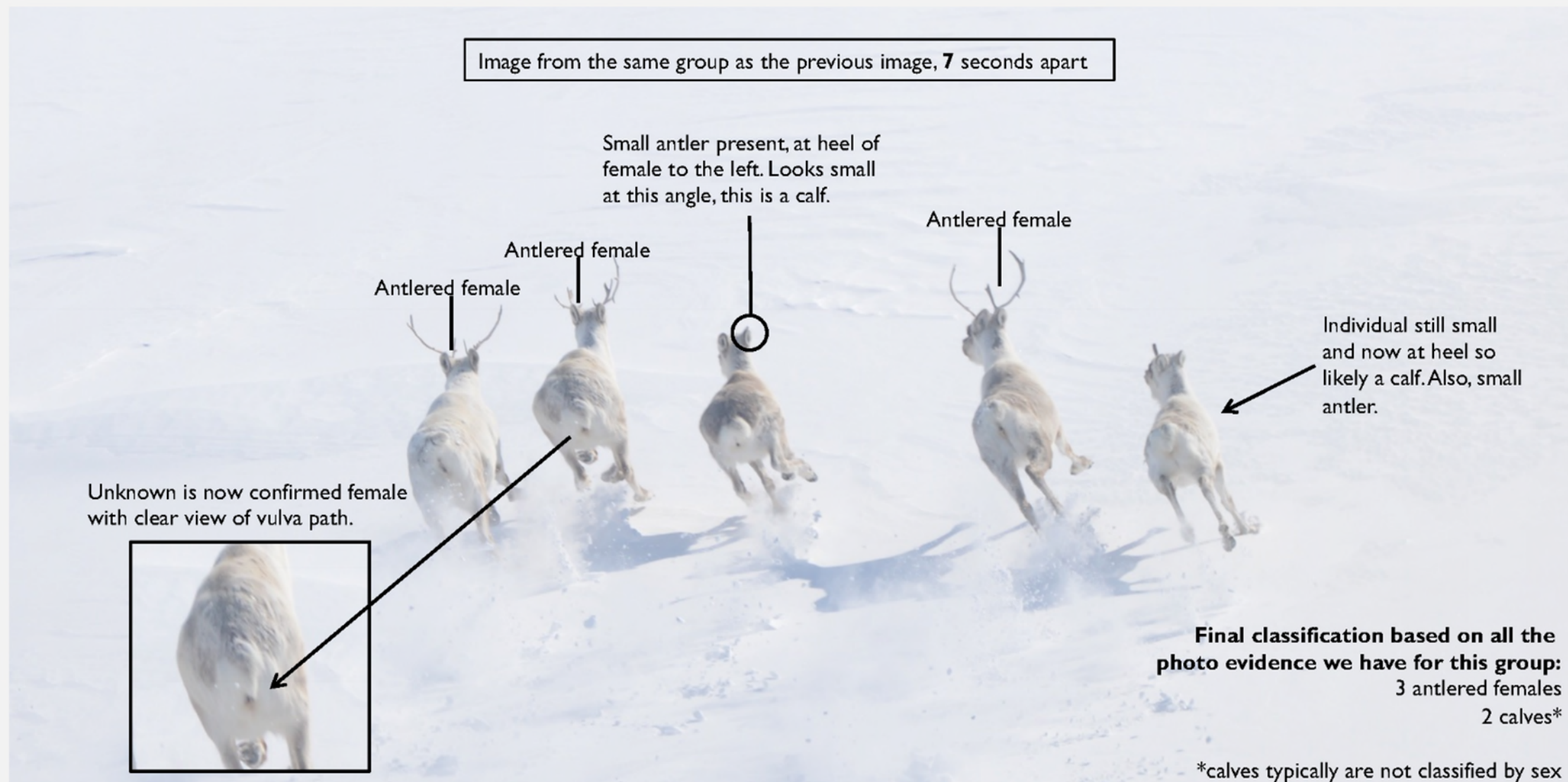


Now we can easily combine our observations for **antler** and **vulva patch** presence

NOTE: despite this image being shot at f8.0, 1/2500s, with focus tracking mode active, it could be sharper. The settings as mentioned are spot on, but the focus isn't. This can be a case of the camera struggling to lock focus on an animal which is low contrast on a bright background, as it moves through snow. Photographer did everything right with the settings. This is why we take burst shots, to help with retention rates, give us different angles on animals, and to compensate for camera error. Cold temperatures drain batteries quickly, and a low battery performs poorly.



Aerial photography can be used to: **get different angles on a group and confirm calf presence**



Even blurry images contain useful information; **NEVER** delete images while in a survey for this reason

NOTE: This image is from the same group as the last five slides where we confirmed 3 antlered females and 2 calves. This image just goes to show that even blurry, we can get a lot of information from this group even if this was the only image captured. At minimum group count could be inferred with certainty.



With certainty call would be:
group of 5 individuals
3 antlered unknowns
1 small antler unknown (calf)?
1 unantlered unknown



Here's a photo from the ground that can be used to classify caribou, from the George River herd in Labrador



Total: **18 individuals**



Don't forget that you can: **zoom into a high-resolution image for more information**

Zoomed in version of last image on slide 17.

- (A) Likely a calf due to proximity to female (body shape and size).
- (B) Male grunting. Can tell it is a male by the anatomy of the antlers, the mane, and the grunt call.
- (C) Likely a calf due to body size and small spiked antlers.



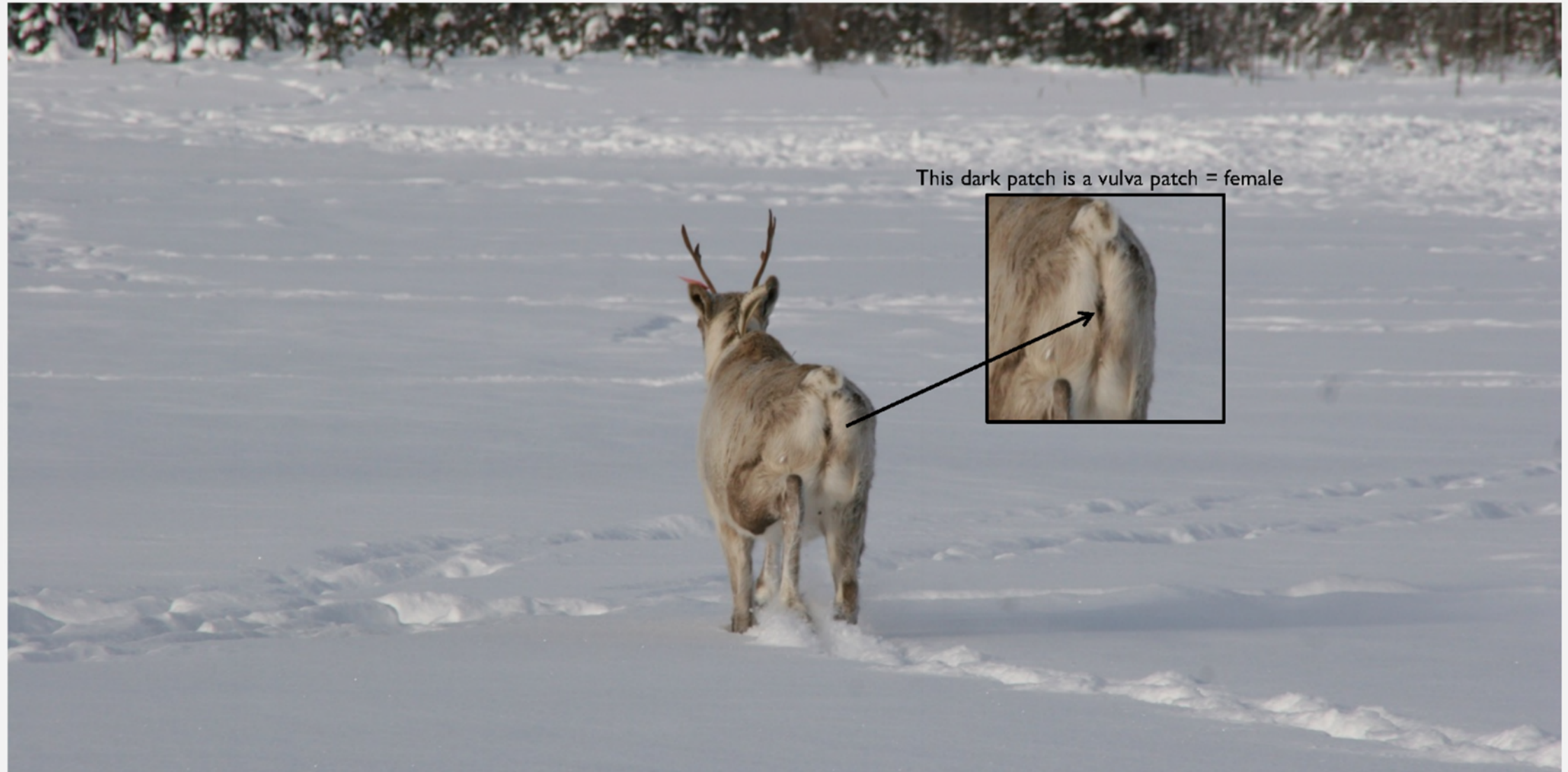
Photograph caribou at any opportunity as it can be used to: **include in communications materials**



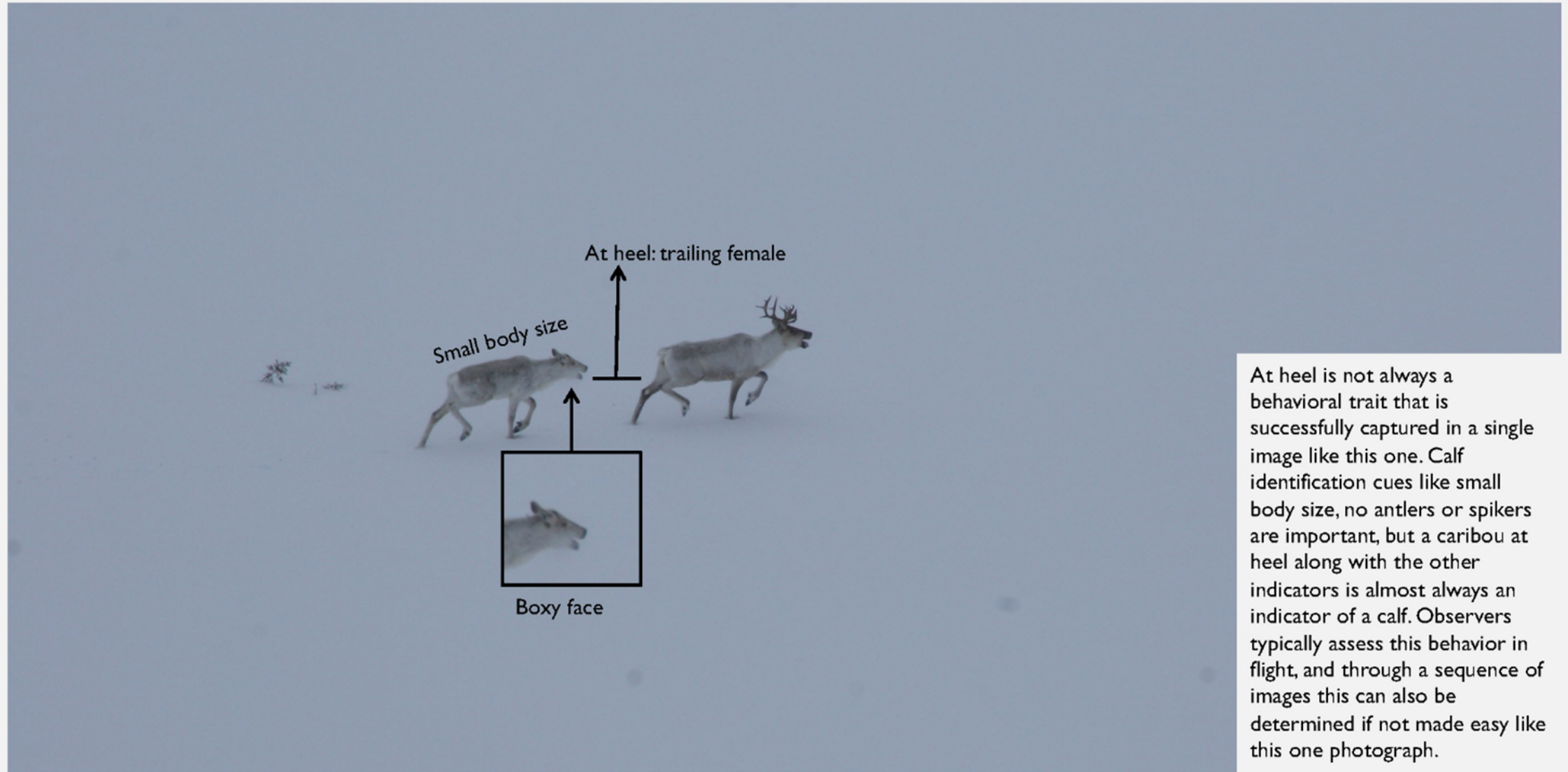
Image of a male caribou with large antlers. Can be used for reports, grant proposals, website content development, knowledge exchange, etc.



Aerial photography can be used to: **train staff on how to identify a female caribou**



Aerial photography can be used to: **train staff on how to identify a calf**



Aerial photography can be used to: **correct for data errors made during the survey**

Aerial data: 29 individuals



Sometimes even in a rotary aircraft, the ideal distance to classify a group cannot be achieved for various reasons. Large groups can be difficult to count within a few seconds especially at this distance, images help support the data or correct it.



Aerial photography can be used to: **revise data collected during the survey**

Aerial data: 29 individuals

Corrected count based on images: 31 individuals



Zooming in allows you to get a perspective you may not have been able to get from the helicopter and makes group counts easier.



Aerial photography can be used to: **positively identify caribou(s) with a collar**



Lastly, it is important to remember that post processing can reveal new details to aid confirm what you 'see'

Same image as previous slide



Same image as left, now post processed: - colour correction

- zoomed in manually

- brought out details in collar to confirm

*RAW files give you more post processing flexibility than JPEGs



AERIAL PHOTOGRAPHY CHALLENGES

- Requires some familiarity with camera equipment and manual camera settings for optimal results.
- Can be difficult to use a long telephoto lens in a helicopter with the constant swaying back and forth, the camera moving around, the helicopter trailing a group, and the animals moving erratically.
- With the great distances travelled in a helicopter in a short time, changing weather patterns and cloud cover require the photographer to make constant small adjustments to the camera settings to best capture the scene. Often trying to delicately balance the ISO, aperture and shutter settings.

INSIDER TIPS

- Equipment
- Camera settings
- Computer software





INSIDER TIPS

EQUIPMENT

- Subjects that can be both moderately close or far require a zoom lens so that you can fill as much of the frame as possible with the interested focal group of animals.
- We strongly recommend getting a 70-200mm f2.8, definitely no wider than 70mm and more reach than 200mm can be beneficial, so use this focal length as a benchmark.
- The constant f2.8 aperture means no matter the weather you are experiencing during an aerial survey, you can let enough light into the lens that you don't have to compromise your shutter speed. Using the appropriate shutter speed is ultimately what makes the difference between a blurry picture, and a sharp one.
- In terms of camera body, simply use a digital body capable of taking RAW images and which also has continuous focus-tracking; a crop-body sensor will get you even more out of your zoom lens at the cost of a few megapixels.



INSIDER TIPS

CAMERA SETTINGS

- For moving subjects use a continuous tracking focus mode.
- If shooting on the 70-200, aperture should always be set as wide as possible i.e., the smaller the number, so that the maximum amount of light can enter the lens. This does come at the cost of shallower depth of field i.e., less of the scene around your focus point is in focus. For larger groups, you can stop down the lens e.g. from f2.8 to f4.
- Shutter speed should be set at no less than 1/150s to capture sharp images. Ideally you want 1/250s+.
- Most importantly, if your camera is capable, shoot in the file type RAW as it will give you the greatest flexibility when post processing and allow you ample room to correct for bad exposures during the aerial survey.



INSIDER TIPS

CAMERA SETTINGS (CONT'D)

- Always shoot in burst mode, 3-4 images every time you look down the lens.
- It is also important to always start taking pictures of a group by having that first picture be a wide shot of the group before subsequent images display smaller portions of said group. That initial picture allows for a recount of the group numbers before using tighter compositions to say assess sex and age structure.
- A fast SD card like a UX10 allows for quick write speed to the camera to liberate some CPU for tracking.
- Cold weather drains batteries quickly. Always bring at least two spare batteries and keep the spares in your breast pocket to keep warm. When batteries are cold or low power, focus will be more difficult to lock onto your group.
- **NEVER** delete any images while flying a survey, you never know how useful they might be.



INSIDER TIPS

COMPUTER SOFTWARE

- Any software capable of editing the RAW files from your camera.
- The key is in pushing the shadow sliders as this reveals more detail in dark spots. For example, you may have a picture of what you thought was a caribou bull under-exposed. By pushing the shadow slider, you can now see a vulva patch and thus determine it is a caribou cow.
- Without the intent of worrying about picture quality if you were to print the image, experiment with the shadow/highlight and exposure sliders to bring out whatever details are necessary to help identify what is needed in an image.
- It helps to process images alongside the data collection survey sheet so that you only try to authenticate one group at a time. All images belonging to a group should be written down on the data sheet e.g., found caribou cow collar 172.46 and notes state images from camera X with filename ABC1 to ABC5 all belong to that one group.

CONSIDERATIONS

- Aerial photography is not only a useful tool for woodland caribou surveys but can be applied to barren-ground caribou surveys, as well as any ungulate which exhibit forms of sexual dimorphism. Additionally, aerial photography can be used to confirm group counts of bison (Franco Alo - personal communication).
- Aerial photography is not a substitute for lack of training in properly identifying the target species of a survey. Though it allows for data to be viewed back at the office where professionals can address the contents of the image, the best use of this tool is when the user both understands the identifiable features/behaviour of the census species and when trained to use the photography equipment to maximize supplemental information being captured.