

# Evaluating the effectiveness of the South Sandwich Islands marine protected area for protecting penguin prey resources

Antarctic Science Bursary 2019

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## THE EXPEDITION

### JANUARY 2020

To reach the South Sandwich Islands, we sailed for five days from the Falkland Islands through heavy seas on the sailing yacht *Pelagic Australis*. Notorious for bad weather and tricky landings, the South Sandwich Islands are rarely visited, and we were the first team to visit them after several volcanic eruptions had occurred in 2016. My objectives during the expedition were threefold: 1) to assess whether volcanic activity had caused a decline in the penguin populations on the islands; 2) to deploy satellite tracking devices on Chinstrap Penguins to determine where they foraged during the breeding season; and 3) to collect faecal samples from all penguin species to determine what they were feeding on. Very little is known about the penguins breeding in the South Sandwich Islands, and although the islands are protected by the South Georgia and South Sandwich Islands Marine Protected Area, we were keen to provide some baseline foraging data for the penguin populations and to assess whether the 50km no-take zone around the islands was sufficient to protect penguin prey resources.



Figure 1. Left: Gemma Clucas and Sophie O'Neill sailing *Pelagic Australis*; photo by Skip Novak. Center: The expedition team; photo by Tom Hart. Right: *Pelagic Australis* at anchor off Saunders Island, South Sandwich Islands, with Mount Michael venting in the background; photo by Tom Hart.

Saunders Island was our first destination, where we immediately deployed our ARGOS PTT tracking devices on 20 incubating Chinstrap penguins. We affixed the trackers to the feathers on the lower backs of the adults (Figure 2) and programmed them to send positional data while the penguins were at sea, allowing us to monitor their foraging movements from January through to late February, when the penguins would moult and shed the devices. All adults immediately returned to their nests and resumed their parenting duties, seemingly unphased by their new accessories! Next, I collected a number of samples from around the island. These included faecal samples which, combined with DNA metabarcoding, I will use to study diet and foraging niche separation among Adélie, Chinstrap, and Gentoo penguins. I then collected a number of ancient bone, feather, and eggshell samples that were buried under layers of volcanic ash to look at changes in diet over time (Figure 2). Finally, I helped Tom Hart conduct surveys using a UAV (drone). Taking photos

from the drone, we can quickly and easily get nest counts for all species to estimate the impact of the volcanic eruptions in 2016. It was a busy three days on Saunders Island but we got a lot done.



Figure 2. Upper left: Chinstrap penguins on Saunders Island; photo by Gemma Clucas. Upper right: a satellite tracker on a Chinstrap penguin prior to release; photo by Gemma Clucas. Lower left: Gemma launching the UAV off the yacht; photo by Hamza Yassin. Lower right: Gemma collecting ancient penguin samples from the volcanic ash; photo by Tom Hart.

We then island-hopped our way through the archipelago, flying the UAV over colonies to get nest counts and collecting faecal samples when it was possible to get ashore. The UAV really came into its element as we neared Zavodovski Island, home to over 600,000 Chinstrap penguins, but surrounded by steep cliffs that make landings possible only in the calmest of seas. The volcano on the island had erupted in 2016, and so we were anxious to get a count of the population post-eruption. However, hurricane force winds were approaching from the west, so we could not wait for the right conditions to attempt a landing. Instead, skipper Chris Kobusch sailed us around the island while Tom and I flew the UAV off the boat, allowing us to get nest counts without the need to step ashore.

## RESULTS

### OCTOBER 2021

Using the tracking data that we collected, I have developed habitat models for Chinstrap penguins and determined their foraging ranges during the chick-rearing period. I found that most foraging trips occurred within the bounds of the South Sandwich Islands Marine Protected Area, meaning that if a krill fishery were to develop around the islands, it shouldn't be in direct competition with the penguins during the breeding season, as vessels would not be able to fish in their key foraging areas. These preferred areas were best characterised by the distance from the colony and the sea surface temperature, and, using these two covariates, we were able to predict foraging habitat preferences around all islands with high confidence. This work is currently in review. Follow-up studies should focus on tracking the winter movements of the Chinstraps where they may overlap with krill fishing activities.

A paper reporting our findings from the UAV surveys of the islands is also currently in review. The surveys showed some impact of the volcanic activity on the penguin populations in the South Sandwich Islands, but the impacts appear to have been small relative to the size of the populations, and so are not of great concern for the species as a whole. Finally, my analysis of the diets of penguins in the South Sandwich Islands and niche separation among them is ongoing and will likely be published in 2022.